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Exploring Novice Teachers' Cognitive Processes Using Digital Video Technology: A Qualitative Case Study

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ACCEPTANCE

This dissertation, EXPLORING NOVICE TEACHERS' COGNITIVE PROCESSES USING DIGITALVIDEO TECHNOLOGY: A QUALITATIVE CASE STUDY, by YUELU SUN-ONGERTH, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

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ABSTRACT

EXPLORING NOVICE TEACHERS'COGNITIVE PROCESSES
USING DIGITAL VIDEO TECHNOLOGY:
A QUALITATIVE CASE STUDY
by
Yuelu Sun-Ongerth

This dissertation describes a qualitative case study that investigated novice teachers' video-aided reflection on their own teaching. To date, most studies that have investigated novice teachers' video-aided reflective practice have focused on examining novice teachers' levels of reflective writing rather than the cognitive processes involved during their reflection. Few studies have probed how novice teachers schematize and theorize their newly acquired and/or existing knowledge during video-aided reflection.

The purpose of this study was to explore novice teachers' cognitive processes, particularly video-aided schematization and theorization (VAST), which is a set of cognitive processes that help novice teachers construct, restructure and reconstruct their professional knowledge and pedagogical thinking while reflecting on videos of their own teaching. The researcher measured novice teachers' VAST by examining their schema construction and automation in terms of schema accretion, schema tuning, and schema restructuring. The study attempted to answer the following questions: a) What is the focus of novice teachers' video-aided reflection? and b) How do novice teachers connect the focus of their reflections to their prior knowledge and future actions?

The findings indicate that video-aided reflection could help novice teachers (1) notice what was needed to improve in their teaching practice, (2) realize how various elements in teaching were interrelated, and (3) construct, restructure, or reconstruct their professional knowledge – in other words, develop their schemata about teaching and

learning through VAST. With a more developed and mature schemata, novice teachers could be able to better understand the various elements involved in teaching and learning, and handle the situations they encounter in their teaching. This may be because people's schemata can provide the link between concepts and patterns of what they do (Rumelhart, 1980).

This research has provided a new way to look at novice teachers' video-aided reflection: how the cognitive processes they experience during their reflection can help them develop the knowledge about teaching and learning, and how their cognitive development can help them grow toward becoming teaching experts. The research findings could: a) add to the knowledge base on teacher education, b) inform the literature related to novice teachers' self-reflection and professional development, and c) expand the knowledge base about the use of video technology in the field of teacher education.

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DEDICATION

This dissertation is dedicated
in memory of my father,
Xusheng Sun

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LIST OF ABBREVIATIONS

VAST	Video-Aided Schematization and Theorization
CIR	Critical Incident Reflection
RiA	Reflection-in-Action
RoA	Reflection-on-Action
RfA	Reflection-for-Action

CHAPTER 1

INTRODUCTION

Introduction

Teachers learn from their experiences. According to Shulman (1987), "This is what a teacher does when he or she looks back at the teaching and learning that has occurred, and reconstructs, reenacts, and/or recaptures the events, the emotions, and the accomplishments. It is that set of processes through which a professional learns from experiences" (p. 19). According to Kolb (1984), "learning is the process whereby knowledge is created through the transformation of experience" (p. 38). Experience plays a central role in the learning process, thus learning that is derived from experience is called experiential learning (Kolb, 1984). Experiential learning employs a "holistic integrative perspective on learning that combines experience, perception, cognition, and behavior" (Kolb, 1984, p. 21). In teacher education, novice teachers are encouraged not only to have experience, but also to learn from their experiences (Feiman-Nemser, 2001). It is the way novice teachers interpret their teaching experience that is essential to making meaning, and hence essential to learning (Mezirow, 1998). Teacher preparation programs, therefore, aim to provide novice teachers with experiences such as practical teaching, reflective practice, and professional development (NCATE, 2008).

For decades, educational psychologists and educators have sought for a better understanding of novice teachers' learning and/or cognitive processes, particularly how novice teachers learn from their experience through reflection (Korthagen & Lagerwerf, 1995; Schön, 1987; Shuell, 1990). Teacher cognition has been defined as "pre- or in-service teachers' self-reflection; beliefs and knowledge about teaching, students, and

content; and awareness of problem-solving strategies endemic to classroom teaching" (Kagan, 1990, p. 19). Cognitive processes can lead to two outcomes – generation of behavior and generation of knowledge. Behavior is external and can be observed, while knowledge is internal and invisible, happening in an individual's mind when he/she processes stimuli from reality (Gadner, Buber, & Richards, 2004). Therefore, it is critical that teacher education programs and teacher educators design their curriculum and instruction to help novice teachers' construction of knowledge about teaching and learning, and help facilitate the generation of subsequent actions they will take in their teaching practice. Likewise, Korthagen (2001) urges for a better understanding of teacher cognition so that teacher education programs can create curricula and learning environments that can better help novice teachers gain expertise in the teaching profession.

Statement of Problem

Literature indicates that in their development towards being experts, novices go through three phases or levels of learning: initial phase, intermediate phase, and terminal phase or image formation level, schematization level, and theory building level. The transition from one level to another is essential in the development of expertise. We, however, currently do not have a clear understanding about how transitions between the levels of learning occur and what factors precipitate them (Korthagen & Lagerwerf, 1995; Shuell, 1990).

There are propositions that encourage cognitive conflict to promote transitions from one level to the next, such as encouraging novice teachers to critically examine their pre-existing educational experiences and beliefs about teaching, learning, children,

and culture. However, little research has been done to address the challenges of teachers' transition from one level of learning to the next. Even less has been done to examine whether this can be done using technology. As Winn (2004) pointed out, in the field of instructional design and technology, research about promoting the transition from novices to experts with the use of technology is an area educational technologists could profitably have devoted more of their attention.

> The way in which mental representation changes with the development of expertise has perhaps received less attention from educational technologists than it should. This is partly because instructional prescriptions and instructional design procedure (particularly the techniques of task analysis) have not taken into account the stages a novice must go through on the way to expertise, each of which requires the development of qualitatively different forms of knowledge. (Winn, 2004p. 95)

One of the recommended solutions for novice teachers' development is through effective reflection. Reflection plays an important role in cognition because effective reflection can help novice teachers to restructure their prior understanding and pedagogical thinking (Calandra, Brantley-Dias, Lee, & Fox, 2009) and to develop a knowledge base that is meaningful to them (Wubbles, Korthagen, & Broekman, 1991). It is probably one of the main factors that help learners make the transition from one learning phase to another (Korthagen & Lagerwerf, 1995; Shuell, 1990).

Reflective practice has been deemed critical for novice teachers' learning and professional development (Dewey, 1933; Schön, 1983, 1987; van Manen, 1977). Although the value of reflection is widely recognized in teacher education, there is no agreement upon what kind of reflections should be encouraged and how they should be prioritized. Debates about the issue of reflective practice have been going on for several decades, with various foci (Fendler, 2003). One of the criticisms is that there seems to be

"a tendency to prioritize the content of teachers' reflection" (Tsangaridou & Siedentop, 1995) using measurement that prescribe on what teachers should reflect, one of which is van Manen's (1977) commonly-cited hierarchy of reflection. The hierarchy has three levels: a) technical issues, b) contextual issues, and c) critical issues. This hierarchy, to some degree, implies a "prescription" for evaluating teachers' reflection, rather than a "description" of the "actual problems teachers encounter in the classroom and those which they nominate as significant" (Tsangaridou & Siedentop, 1995, p. 229) . Just as Graham (1991) urges, the question should not focus on whether to promote reflection on the technical aspect of teaching or to encourage reflection on such issues as social justice because "the nature of the subject matter and the learning environment suggest that each of these focus is not only a desirable focus of students' reflection but also a critical focus". (Graham, 1991, p. 14) .

Calandra, Dias and Dias (2006) also argue that analyzing novice teachers' levels of reflection alone cannot capture the complexity of the reflection. A more comprehensive and multidimensional approach is needed (Brantley-Dias, Dias, & Rushton, 2008; Calandra, et al., 2009; Fox, Dias, & Calandra, 2007). Moreover, research on reflective practice should also help researchers and teacher educators gain "insights into teacher development and the nature of the relationship between teacher cognition and teacher behavior" (Korthagen & Kessels, 1999, p. 4).

Various strategies have been employed to improve novice teachers' reflective capabilities, including journal writing, supervisory conferences, microteachings with reflective teaching journals, multimedia cases, online discussion, peer observation conferences, portfolios, the use of critical incidents, and video (Calandra, et al., 2006).

Video technology has long been used in teacher education to capture microteaching, and illustrate classroom practices. Advancements in the capabilities of digital video technology has encouraged an increased interest recently in the use of video to facilitate teachers' reflective learning (Rich & Hannafin, 2009). Research findings have proven that video can be useful in promoting the reflection of novice teachers (e.g. Sherin, 2007) as it can be used to capture the complexity and reality of the classroom. This affordance of technology allows teachers to review videos of their own teaching practice for analysis and reflection (van Es & Sherin, 2002; Wang & Hartley, 2003).

In recent years, the use of digital video technology to improve novice teachers' reflection has attracted ever-increasing interest from researchers and educators (Brantley-Dias, et al., 2008; Calandra, Brantley-Dias, & Fox, 2007; Calandra, et al., 2009; Calandra, et al., 2006; Crawford & Patterson, 2004; Elbaz, 1988; Eraut, 1994; Girod, Bell, & Mishra, 2007; Petrosino & Cunningham, 2003; Spurgeon & Bowen, 2001). This technology is believed to be particularly useful for "providing authentic, meaningful, reflective experiences for novice teachers" (Calandra, et al., 2009).

Few studies, however, have investigated novice teachers' cognitive processes that are involved in the reflection aided by videos of their own teaching, such as the schematization and theorization of novice teachers' knowledge about teaching and learning – something that is indispensable in the professional development of novice teachers. Schematization means to form a schema or schemata. Schema is a mental codification of experience that includes a particular organized way of perceiving cognitively and responding to a complex situation or set of stimuli. It exists in our memory as an organized structure that, together with all other schemata we have, consists

of our whole knowledge (Paivio, 1974). Unlike our immediate experiences, which are more concrete and contextual, our schemata are organized at a higher level of generality, or abstraction. Schema is dynamic and can be changed through general experience or instruction. It not only helps us interpret new experiences and knowledge, but it also provides a structure to hold our newly-acquired knowledge (Winn, 2004, p. 86)

The term "schema" was first used in education by Piaget (1926), then used as a basic concept of learning by Bartlett (1932), and later expanded in his schema theory by Anderson (1977). According to Rumelhart (1980), schemata can help us understand the world and handle everyday situation effectively because our schemata provide the link between our concept and patterns of what we do. Eventually even the more complex situations are handled automatically without much effort.

Learning is supposed to occur when schemata changes. Schemata changes through assimilation and accommodation: taking the form of schema accretion, schema tuning, and schema creation. Schema assimilation means incorporating new concepts into existing schemata through schemata accretion and tuning, while schema accommodation means modifying the existing schema to fit to new experience as in creating a new schema (Rumelhart, 1980; Wouters, Tabbers, & Pass, 2007). Schematization is the process of forming schemata. It is originated in a need for more clarity. This clarification of the new images and new experiences provides an individual the opportunities to explain and justify what he/she is doing, and to verify the result. It occurs when an individual's schema changes through schema accretion, tuning, and restructuring (Korthagen & Lagerwerf, 1995). Theorization is originated in a need for the organization of the constructed schemata. It is the logical structuring of the schemata. It occurs when

an individual is making a network to connect different schemata (Korthagen & Lagerwerf, 1995). Therefore, the schematization and theorization processes that novice teachers experience play an important part in the construction, restructuring, and reconstruction of their professional knowledge and pedagogical thinking. However, the cognitive processes that novice teachers experience, particularly those related to schematization and theorization, is an area that needs more research. This study attempts to address the above-mentioned issue, and thus fill a notable gap in the literature.

Purpose

The purpose of this study was to explore novice teachers' video-aided schematization and theorization (VAST), which is a set of cognitive processes that help them construct, restructure and reconstruct their professional knowledge and pedagogical thinking while reflecting on videos of their teaching.

I developed VAST based on existing research that is related to novice teachers' schematization and theorization and used it as the theoretical framework of this study. VAST describes the cognitive processes that help novice teachers build their schemata and theory, or network of schemata, about teaching and learning when they watch and reflect on the videos of their teaching. Although some research has investigated the schematization and theorization of novice teachers (Korthagen & Lagerwerf, 1995; Shuell 1990), no research has directly investigated how video technology affects the schematization and theorization of novice teachers while they are watching and reflecting on their video-recorded teaching experience. This study aimed at exploring how novice teachers' video-aided reflection could affect the construction, restructuring and re-construction of their knowledge about teaching and learning, or their schematization and

theorization. It was hoped that the research findings could contribute to the knowledge base of both teacher cognition and the use of digital video technology in teacher education.

Research Questions

The overarching question of this research asks how video-aided reflection affects novice teachers' cognitive processes that are related to schematization and theorization. The specific research questions are:

- What is the focus of novice teachers' video-aided reflection? and
- How do the novice teachers connect the focus of their video-aided reflection to their prior knowledge and future actions? , i.e., how does their video aided schematization and theorization (VAST) work?

The first research question, "What is the focus of novice teachers' video-aided reflection," aimed to address the issue that prioritize the content of teachers' reflection and the potential problems it could lead to because novice teachers had different background and experience, and hold different pre-existing beliefs and knowledge about teaching and learning. To get a whole picture of novice teachers' reflections, a thorough examination of the content of the reflection is needed. Because what novice teachers focus on in their reflection is deemed as being important and key to their schematization and theorization, a descriptive, rather than a prescriptive approach was employed in the analysis of their reflections.

The second research question, "How do novice teachers connect the focus of their video-aided reflection to their prior knowledge and future actions" focused on novice teachers' schematization and theorization processes, or the processes during which they

construct the schemata about teaching and learning and how they planned to apply their constructed schemata in dealing with the everyday situations they encounter in their teaching. An examination of these processes can help researchers understand how novice teachers make connections between theory and practice, restructure and re-construct their professional knowledge and pedagogical thinking, and make plans to apply their newly acquired and/or restructured or reconstructed knowledge into their future action.

Significance

This research provides a new way to look at novice teachers' video-aided reflection, how the cognitive processes that they experience during their reflection help them develop knowledge about teaching and learning and how their cognitive development can help them grow towards becoming teaching experts. The research findings is hoped to: a) Add to the knowledge base on teacher education, b) inform the literature related to novice teachers' self-reflection, professional knowledge, and pedagogical thinking, and c) expand the knowledge base about the use of video technology to enhance teacher cognition.

Terms and Definitions

1. Teacher cognition is defined as "pre- or in-service teachers' self-reflection; beliefs and knowledge about teaching, students, and content; and awareness of problem-solving strategies endemic to classroom teaching" (Kagan, 1990, p. 19).
2. VAST is the acronym for video-assisted schematization and theorization. It describes the cognitive processes that help novice teachers build their schemata and theory

about teaching and learning when they watch and reflect on the videos of their teaching. During the VAST processes, novice teachers construct or reconstruct their schemata and the network of their schemata, which will eventually help them deal with the everyday teaching situations automatically.

3. Levels of knowledge depicts a hierarchy of six levels of knowledge – the knowledge level, the comprehension level, the application level, the analysis level, and the synthesis level, and the evaluation level. As it is a hierarchy, a person is not able to perform higher levels of tasks without first mastering the lower levels of knowledge, which means that he or she is not capable to apply, analyse, synthesize, or evaluate some information before he or she actually has known or understood the information (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).
4. The concept of phases of learning maintains that learners go through three phases in learning about a subject – the initial phase, the intermediate phase, and the terminal phase. At the initial phase of learning, novice learners memorize isolated facts and pieces of information, and uses pre-existing schemata to interpret the isolated pieces of data. At the intermediate phase, as the relationships of the acquired knowledge are better developed, they are organized into higher-order structures and networks to form new schemata, which render the learners more conceptual power. At the terminal phase, the knowledge structure and schemata that are formed during the intermediate phase are better integrated into other existing schemata and are functioning more automatically (Shuell, 1990).
5. The concept of levels of learning maintains that learners go through three phases in learning about a subject – image formation level, schematization level, and theory

building level. At the image formation level, learners establish images or concepts about something that come out of a range of familiar examples or experiences. Those images are mostly isolated and unrelated. At the schematization level, learners establish schema or schemata, based on the images, which includes all kinds of interrelated details. At the theory build, or theorization level, learners develop a theory or interrelated schemata that consist of basic assumptions, definitions, and logical inferences (Korthagen & Lagerwerf, 1995).

6. Reflection is defined as the ability to make deliberate choices. It is a fundamental concept in educational theory, and in some sense, it is just another word for 'thinking.' To reflect is to think. But reflection in the field of education carries the connotation of deliberation, of making choices, of coming to decision about alternative courses of action (van Manen, 1991, p. 98).
7. Levels of reflection are categorized based on the content of the reflection. Technical reflection focuses on applying knowledge and skills to reach a given goal. Contextual reflection focuses on analyzing and clarifying meaning, practices, assumptions, and perceptions underlying practical actions. Critical reflection focuses on questioning critically the moral, ethical and political aspects of teaching and learning (van Manen, 1977).
8. Reflection-in-action refers to reflection on the spot or when an event is happening. It involves reflection, examination and evaluation of current experience, feelings, and the use of theories (Schön, 1983, 1987).

9. Reflection-on-action refers to reflection after the event has occurred. It involves retrospection on the event, and the motivations and rationale for the action taken (Schön, 1983, 1987).
10. Reflection-for-action refers to reflection not only on the past, but also for the future. It involves revisiting the past and becoming aware of the metacognitive process one is experiencing as well as providing the rationale to guide future actions (Killion & LaRocco, 2006).
11. Schema is "an organized structure that exists in memory and, in aggregate with all other schemata, contains the sum of our knowledge of the world (Paivio, 1974). It exists at a higher level of generality, or abstraction, than our immediate experience with the world. It is dynamic, amenable to change by general experience or through instruction. It provides a context for interpreting new knowledge as well as a structure to hold it" (Winn, 2004, p. 86).
12. Schema theory argues that learning occurs when schemata changes, namely when the learner is accommodating to new information in the environment or assimilating the new information. Learning is likely to take place as we modify or create our schemata in the form of schema accretion, schema tuning, or schema restructuring/creation. (Wouters, et al., 2007).
13. Schema accretion occurs when the new information can easily fit into a slot in an existing schema, and thus be quickly comprehended. It is a simple addition of new information into existing schema. Schema accretion is similar to fact learning, and information is remembered that was used as an instance within a schema, such as a

result of text comprehension or understanding of an event(Rumelhart & Norman, 1981).

14. Schema tuning occurs when the existing schema has to be adjusted to accommodate the new information; thus, making the existing schema more accurate, complete, or useful. In other words, existing schemata become more consistent with experience, incorporating minor schema modification (Rumelhart & Norman, 1981).
15. Schema restructuring occurs when the new information cannot fit into an existing schema; thus, an entirely new schema has to be created to replace or incorporate the old ones in order to hold the new information (Rumelhart & Norman, 1981).

Summary and Overview

In summary, novice teachers learn from their experiences by looking back at what has occurred in their teaching. During the process of reflecting on their previous experience, a novice teachers "reconstructs, reenacts, and/or recaptures the event, the emotion, and the accomplishments" (Shulman, 1987, p. 19). Research on teacher reflective practice has so far focused more on the prescriptive strategies to promote novice teachers level of reflection than on describing and interpreting the cognitive process that novice teachers have experienced. To better understand novice teachers' reflection and to help them construct their professional knowledge and pedagogical thinking, a close examination of their cognitive processes during reflection is needed. The fast development of digital video technology has provided new opportunities for novice teachers to interact with their learning environment and be engaged in relevant cognitive processes (Wouters, et al., 2007). These opportunities are believed to help novice teachers develop their expertise through persistent reflection on very specific problems of

teaching and critical analysis of their teaching beliefs, and help them develop necessary skills and dispositions for continued professional development (Petrosino & Cunningham, 2003).

The next chapter, Chapter 2, is a review of literature that has informed the development of the theoretical framework used to guide this research on VAST. Literature review is useful because it can help me refine the research questions, select appropriate methodology, and adequately interpret the findings (Merriam, 1991). Chapter 2 discusses the literature related to the theoretical framework and related to empirical studies. Following Chapter 2 is Chapter 3: Methodology, which describes the research method, the context, participants and sampling, data source, collection, and management, data analysis, trustworthiness, and limitation of the research. After Chapter 3 is Chapter 4: Findings, which is the report of the results the data has revealed in this study. The last chapter is chapter five: Summary, Discussions and Implications, which link the findings of this research back to previous work that are described in Chapter 2.

CHAPTER 2

LITERATURE REVIEW

This chapter is a review of the related theories and empirical studies that has helped me in the development of the theoretical framework of this study. The purpose of the literature review is to inform the reader of the theoretical underpinnings, empirical, and methodological guidelines of this research endeavor. A literature review is important for any research because it can help the researcher form the research problem, select the appropriate methodology, and interpret the research results. As is stressed by Merriam (1991), research "are best interpreted in light of what was previously known about the topic. Linking specific findings to previous work demonstrates to the reader just how this study contributes to the developing knowledge base of the field" (p. 63).

Introduction

This chapter consists of two parts: literature that is relevant to the theoretical framework of this dissertation and empirical studies that other researchers have conducted. Multiple theories that are related to cognition, reflection and experience have provided insights to the development of VAST – the theoretical framework for this research, including but not limiting to schema theory, theory of phases and levels of learning, and reflective learning. The empirical studies that have informed this study are relevant to digital video technology, and its use in education – particularly in the field of teacher education.

Literature Related to the Theoretical Frameworks

As mentioned in chapter one, learning is a continuous process that combines experience, perception, cognition, and behavior. Grounded in experience, learning occurs when people generate knowledge through reflection on their previous experience. Therefore, the meaning structures of knowledge are better understood and developed through reflection (Kolb, 1984). When people reflect on their past experience, they refine or elaborate meaning schemes, learn new schemes, transform schemes, or transform meaning perspectives (Mezirow, 1981). Such a learning process is challenging, filled with tension and conflict; thus, "requires the resolution of conflict between dialectically opposed modes of adaptation to the world" (Kolb, 1984, p. 29).

The greatest challenge for any professional to learn is not to apply new theoretical knowledge, but to learn from experience. Just as Cochran-Smith and Lytle (1999) put it, "members of professions have to develop the capacity to learn from the experience and contemplation of their own practice" (p. 535). Reflected in the field of teacher education, novice teachers are more likely to learn and bridge the gap between theory and practice through the analysis and reflection about situations, knowledge, theories, and problems about teaching and learning (Korthagen, 2001), which will eventually help address the challenge that novice teachers have encountered in linking the theoretical knowledge they have learned in the teacher education program to their practical personal knowledge that drives their decision-making in teaching (Korthagen & Kessels, 1999).

Novice teachers constantly experience and process information about teaching during their development. They actually have two jobs —"they have to teach and they have to learn to teach (Feiman-Nemser, 2001, p. 1026). Novice teachers acquire

practical knowledge through their reflection on the act of teaching, meaning that the way novice teachers acquire knowledge and the situation in which they learn become fundamental parts of their learning process (Cochran-Smith & Lytle, 1999; Putnam & Borko, 2000).

Richards (2009) points out that analysis of the knowledge construction of novices and experts indicates that novices spend much of their time and efforts following rules, and most of the time they are not aware of the methods they are using. Experts who, on the other hand, are already familiar with methods that they deem relevant, can easily adapt those methods to "suit their own fields" and combine them with their own experience. Chi, Glaser, and Rees (1982) echo that experts use abstract schemas to facilitate their known knowledge structure. Those abstract schemata "are the result of an increase in reflexivity, which is also closely linked to the degree of familiarity with the action (Richards, p. 29). To understand the differences between novices' and experts' schemas and cognitive processes, It is helpful to have an overview about how humans process and construct their knowledge, and how the knowledge is related to their compentencies.

Reality, Cognition, Knowledge, and Competency

The goal of a cognitive system is to acquire knowledge from reality and subsequently apply the knowledge back to reality. The relation between reality and a cognitive system is established by some kind of links between the two domains. The link is realized by the sensory system and the motor system in the cognitive system in the following matter (Gadner, et al., 2004):

> The sensory system is responsible for transforming environmental states and state changes into internal (that is, representational) signals. This transformation is referred to as the process of transduction. On the output side, motor systems are responsible for transforming representational signals such as 'plans' and 'knowledge' into motor behavior that has a direct physical effect on the internal and external environments. (p. 6)

The cognitive system and the representational structure, namely knowledge, are linked in a "circular fashion", thus forming two feedback loops. The feedback loops work in such a manner that generated behavioral output influences parts of the sensory input, which, in turn, influences the motor output. The loops interact with each other while trying to achieve a state of equilibrium or homeostasis in the representational mechanisms, or the neural structure, which are highly complex and non-linear and are responsible for holding knowledge and transforming input into a non-linear manner (Gadner, et al., 2004). Knowledge can only be found inside a cognitive system because "it is the cognitive system that knows, applies, understands and constructs knowledge" (Gadner, et al., 2004, p. 7). In addition, knowledge can always be anchored to some points of reference in reality. The process of connecting knowledge to the right anchor is the process of cognition, which involves asking the following questions: "What is the object of a particular knowledge structure or knowledge process? that is, to what aspect of reality does a particular knowledge structure or knowledge process refer?" (Gadner, et al., 2004, p. 19).

Knowledge is considered as the premise for any kind of ability. Knowledge is concerned with "knowing" and is considered as an internal category. Ability, on the other hand, is concerned with an individual's skills, or his/her being able to, which is an external category (Gadner, et al., 2004). Knowledge and ability are closely interrelated.

> In order to be able to externalize behaviour, to engage in an (internal or external) action, to make a decision or to show competence in an area, it is necessary to possess the knowledg, on which these abilities are based. What an external observer would interpret as a skill or competency is actually an expression of the cognitive system's internal knowledge, just as any kind of motor action or behavioural dynamics is the result of internal representational dynamics. (Gadner, et al., 2004, p. 11)

Gadner, et al. (2004) describe the process of knowing reality as the process of first turning the raw data and facts that comes from reality into information. Based on the formed information, scientific theories are then developed. Data and facts are the "very first" and "raw representation of the world". They are a result of direct interaction with the environment. Knowledge at this stage is normally "rather poor and far from a comprehensive and coherent representation of the world". Data and facts are, however, the basis, upon which all the other levels of knowledge are built. Information, the contextualized knowledge, based on a theoretical framework, are "as rich and numerous as theories on the nature of the world", but in a form of "unordered knowledge or a representation of the world without any assessment or judgment" (Gadner, et al., 2004, p. 20). Scientific theories, considered as the summit of human knowledge, are the resulting knowledge through the organization of the unordered information (Gadner, et al., 2004). This resulting general knowledge of us is organized in categorical rules or scripts called schemata. Schemata and schema theory help us understand how knowledge is acquired and represented.

Schemata and Schema Theory

Schema plays important roles in many cognitive processes. It helps us pay attention to, comprehend, interpret, remember, make inference, set expectations, reason, solve problems, understand language structure, read, write, and explain what we know

(Grow, 1996). In other words, schemata help us understand the world. They not only determine how we perceive, classify, store, and act upon the information we have received, but they also organize what we know and guide how we use our knowledge. On the one hand, schemata help us simplify our information processing about concepts and situation; on the other hand, due to the cognitive simplification, they can be incomplete, inaccurate and difficult to change.

Just as Pichert and Anderson (1977) explains, our schemata organize our knowledge about specific stimulus domain and guide both the processing of new information and the retrieval of stored information. They function as structured expectations about people, situation, and event. Moreover, they play an important role in information processing either by data or stimulus-driven processing or by schema-driven processing. Data-driven processing occurs when no schema exist from which to process information. In that situation, we have to examine all information or data and proceed through a careful decision making process. Schema-driven processing occurs when we respond to a stimulus, such as decision-making or problem-solving situation, by triggering a programmed response or behavior script (schema), which does not need extensive data collection or analysis.

Schemata are packages of knowledge that are actively processed to represent knowledge at all levels of abstraction. They are mental representations of our generic knowledge about a concept (Fiske & Taylor, 1984). We develop schemata for different concepts and situation. Individuals' schemata are unique because they are developed based on their different experiences and cognitive processes. In addition, schemata are situation-specific, which helps "explain the differences between expert and novice

interpretation of knowledge". An expert can function better than a novice in a particular subject area because they have developed a more complex schema of a specific subject; while a novice has no schema or inadequate schema that can help them interpret and react to new information. In addition, those schemata are context specific; therefore, they are dependent on an individual's experience with a subject and his/her and exposure to it rather than simply raw intelligence (Widmayer, 2011).

Schemata are constructed through experience with specific instances. They start as a simple network and develop into more complex structures. Mature schemata are more extensive, more organized, and contain more characteristics than less mature schemata do. Cognitive scripts can be acquired either directly or indirectly: with direct going through a process and confirmation through repetition, and indirect through stories, myths, films, movies, conversations, or role models (Rumelhart & Norman, 1981). Figure 1 illustrates the well-developed network of an egg schemata (Davis, 1991).

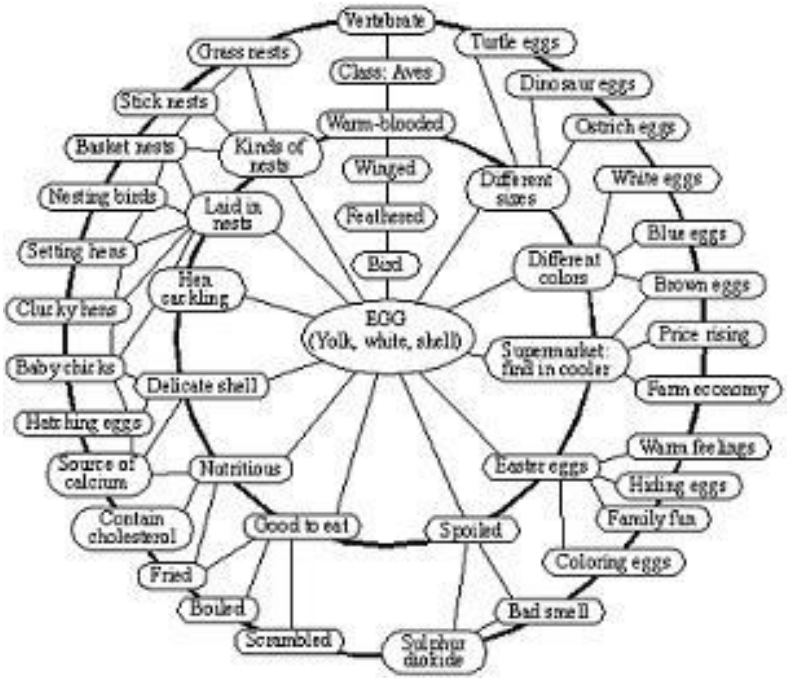

Figure 1. Egg Schema

A schema has six characteristics (Pichert & Anderson, 1977; Winn, 2004). First, it is an organized structure, which exists in our memory to represent the relationships among component parts or elements. Second, it is abstract; existing at a higher level of generality than the immediate experience we have from the world. It consists of summary information and prototypical categories rather than details about a specific case. Third, it is dynamic, open to changes, development and interaction. Fourth, it provides context and vocabulary for interpreting new knowledge as well as a place/structure to hold it. Fifth, it shapes perceptions in one's interaction with the world. Sixth, it organizes experience and modifies itself to accommodate new experience.

From the standpoint of the schema theory, knowledge is viewed as acquired through reflections on previous experience. Schema theory can help "explain the concepts of consciousness, self-awareness, and self-reflection — concepts that certainly affect knowledge acquisition and representation" (Reynolds, Sinatra, & Jetton, 1996, p. 103). According to Anderson (1977),

> A schema represents generic knowledge; that is, it represents what is believed to be generally true of a class of things, or situations. A schema is conceived to contain a slot or placeholder for each component. For instance, a face schema includes slots for a mouth, nose, eye and ears. (p. 2)

Moreover, knowledge is acquired when the mind plays an interactive role with experience in a dynamic way. Reynolds, et al. (1996) summarizes how knowledge is constructed in human mind.

> The mind, in the form of schemata, allows an individual's knowledge to interact with incoming information to form new interpretations. The role of experience is acknowledged as well, because it provides the raw material from which the mind forms schemata. Knowledge is not remembered,…rather, it is created out of the interaction between incoming sense perceptions and the inherent capacities of the mind….It is interactive, but the emphasis is on the mind and internal process of

information representation, organization, and framing. (p. 97)

From the perspective of schema theory, we understand the world in terms of prototypical patterns, which are embedded in a network or relationships, concepts or vocabulary words (Davis, 1991). In other words, those patterns, in the form of schemata, are viewed to express relationships among parts called slots, or nodes. For example, the schemata of a restaurant contains slots of ordering, eating, and paying bills (Grow, 1996), as is illustrated in Figure 2.

In sum, a schema is more abstract representation compared with a direct perceptual experience, thus making it more useful (Rumelhart & Norman, 1981). Moreover, schema is dynamic, meaning that an individual is constantly changing his or her knowledge about the world by interpreting new experience and adapting to it. From the perspective of schema theory, learners build or construct their schemata and revise or restructure them whenever new information is processed and categorized in their cognitive system. In addition, each individual's schema is unique, depending on his or her experience and cognitive processes (Pichert & Anderson, 1977).

Schema theory, when applied to the discipline of teacher education, can help researchers and educators understand novice teachers' schemata about teaching and learning, how they are formed, and how they may affect their future teaching practice. Schemata do not automatically appear in a teacher's mind, they are constructed through experience (Rumelhart & Norman, 1981). The modification of schemata involves a dual process of assimilation and accommodation. Assimilation means fitting the new into the old, while accommodation means changing the old mental organization to incorporate the new. We assimilate or accommodate new acquired knowledge in both bottom-up and

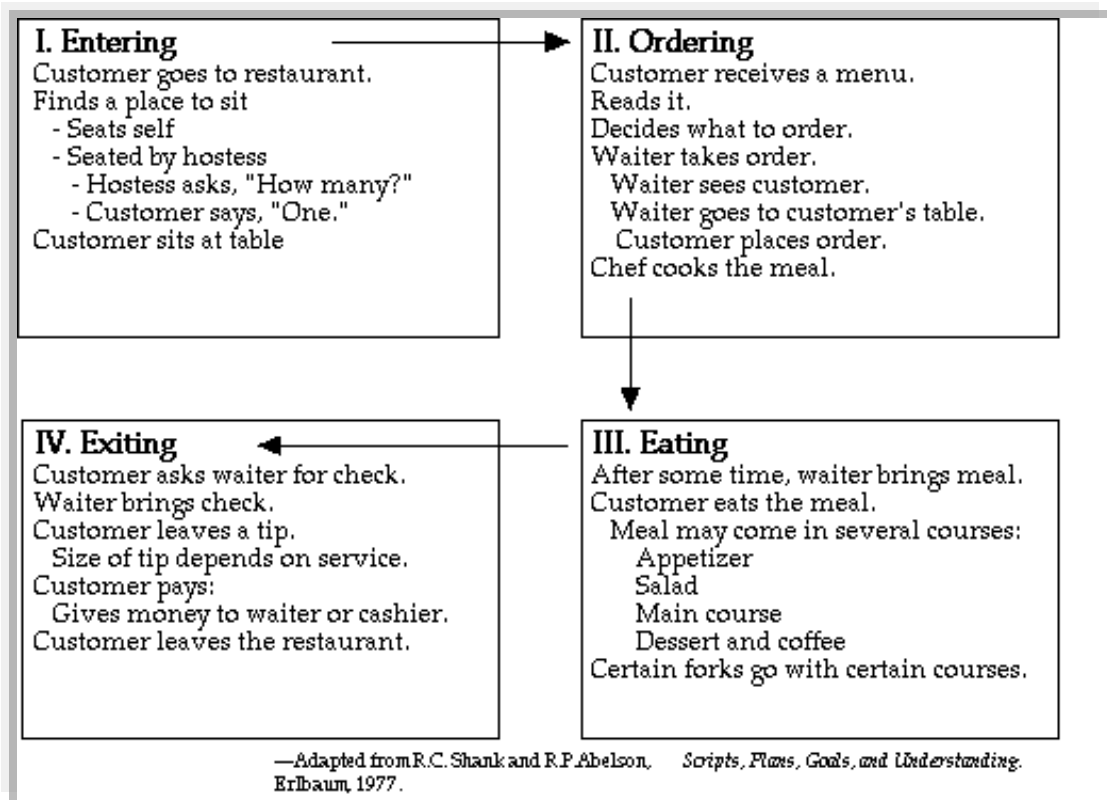

Figure 2. Schema of a Restaurant

top-down manner. When we encounter a new object, experience or piece of information, we attempt to match its features and structure to a schema in our memory in a bottom-up approach. This bottom-up approach can be interpreted as the process of induction to form schemata. Depending on whether the first attempt at matching is successful or not, we construct a hypothesis about the identity of the object, experience, or information, on the basis of which we look for further evidence to confirm our identification – a top-down approach. This top-down approach can be interpreted as the process of deduction using the schemata that have been formed to guide future actions. If further evidence confirms our hypothesis we assimilate the experience to the new or expanded schemata. If it does not, we revise our hypothesis, thus accommodating to the experience (Rumelhart & Norman, 1981).

Learning occurs when schemata change, or when the learner is accommodating to new information in the environment or assimilating the new information. It is possible for learning to take place by accretion, schema tuning, or by schema restructuring or creation. Accretion happens when new information matches an existing schema, which means that the new information is simply added to the existing schema without any accommodation. Schema tuning causes more radical change in a schema by using new information to 'tune" an existing schema so that it is more accurate, complete, or useful. Schema restructuring/creation occurs when no existing schema can be used to incorporate new information through schema accretion or tuning, a new schema has to be created to hold the new information (Rumelhart & Norman, 1981).

Comparison of novice and expert teachers' interpretation of classroom events indicates that expert teachers have richly connected schemata to draw upon when making a decision, while novice teachers tend to have less developed schemata because of their lack of experience (Leinhardt & Greeno, 1986). Furthermore, the knowledge organization of an expert differs from that of a novice.

> Experts appear to solve problems by recognizing and interpreting the patterns in bodies of information, not by breaking down the information into its constituent parts. If automaticity corresponds to the cognitive process side of expertise, then knowledge organization is the equivalent of mental representation of knowledge by experts. There is considerable evidence that experts organize knowledge in qualitatively different ways from novices. It appears that the chunking of information that is characteristic of experts' knowledge leads them to consider patterns of information when they are required to solve problems rather than improving the way they search through what they know to find an answer. (Winn, 2004, p. 93)

Expert schema does not happen overnight. Instead, it grows over time, becoming more complex and ultimately automatized through experience and reflection.

> The knowledge we represent as schemata changes as we work with it over time. It becomes much more readily accessible and useable, requiring less conscious effort to use it effectively. At the same time, its own structure becomes more robust and it is increasingly internalized and automatized. The result is that its application becomes relatively straightforward and automatic, and frequently occurs without our conscious attention. (Winn, 2004, p. 91)

Schema theory has many implications for learning. The implication that has attracted the most attention is how an individual's previously acquired knowledge, stored in the form of schemata, can affect the interpretation of incoming data and how problems are solved. This idea has had a profound impact on education as it treats the learner as an active and involved agent in the learning situation (Reynolds, et al., 1996, p. 97).

The Novice-Expert Approach

The observation of how experts and novices solve problems has revealed seven main dimensions of expertise, which are domain-specificity, greater knowledge and experience, meaningful perception, reflective, qualitative problem analysis, principled problem representation, effective strategy construction, and post-analysis speed and accuracy (Glaser & Chi, 1988). D*omain-specificity* of knowledge means that expertise is generally limited to a specific domain. In other words, expertise in one domain can hardly transfer to another domain. G*reater knowledge and experience*, which shows the largest difference between novices and experts, means that experts have constructed much greater knowledge and skills than novices in an area. Moreover, the constant practice of the skills has enabled experts to perform more quickly and automatically. Furthermore, experts' knowledge and skills are not only greater than that of novices, but also in much more complex, elaborate, and abstract ways. *Meaningful perception* means that experts and novices perceive the same situation differently, with experts seeing the situation as a

whole and novices seeing it as pieces of isolated and discrete parts. *Reflective, qualitative problem analysis* means that experts take time to understand a problem before they make decisions, while novices, instead of taking time to analyse the problem before they come to a solution, make decisions very quickly based on stereotypical responses. In addition, experts, during their problem-analysis phase, try to identify the problem, elaborate on the possible solutions, and build a workable mental representation of the problem. Thus, experts' p*rincipled problem representation* of a problem is more workable with a deeper understanding of the problem than that of novices whose understanding of the problem is in a superficial manner. *Effective strategy construction* means that novices and experts use the same strategies to solve some parts of the problem, but arranged in different order, which is a qualitative rather than a quantitative difference between novices' and experts' strategies in solving problems. *Post-analysis speed and accuracy* means that experts can execute the problem-solving strategies much faster than novices although they spent more time during the problem-analysis phase, meaning that experts spend less time than novices to respond and make fewer errors in their solving problems.

Therefore, just as Byrnes (1996) summarizes,

> There is a natural progression in thinking from lower forms to higher forms with age or experience. This developmental progression implies that students need to have a certain amount of education, experience, or practice before they can become capable of the highest forms of thought…It is unwise to ask beginners to engage in the highest forms of thought right away because the tasks that require this type of thought would either be over their heads or be performed incorrectly…It is wrong to assume that teachers should do nothing to promote thinking until students reach a certain age.
> (p. 69)

Echoed in the field of teacher education is an idea emphasizing comprehension and reasoning, transformation and reflection (Shulman, 1987). Shulman states that teachers

need seven categories of knowledge to be sufficient for teaching: content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, knowledge of educational ends, purposes, and value. He also proposes a model of pedagogical reasoning and action (Shulman, 1987, p. 15), as is illustrated in Table 1.

Table 1

Model of Pedagogical Reasoning

Comprehension
Of purpose, subject matter structures, ideas within and outside the discipline
Transformation
Preparation: critical interpretation and analysis of texts, structuring and segmenting, development of a curricular repertoire, and clarification of purposes
Representation: use of a representational repertoire which include analogies, metaphors, examples, demonstrations, explanations and so forth
Selection: choice from among an instructional repertoire which includes modes of teaching, organizing, managing, and arranging
Adaptation and Tailoring to Student Characteristics: consideration of conceptions, preconceptions, misconceptions, and difficulties, language, culture, and motivations, social class, gender, age, ability, aptitude, interests, self concepts [*sic*], and attention
Instruction
Management, presentations, interactions, group work, discipline, humor, questioning, and other aspects of active teaching, discovery or inquiry instruction, and the observable forms of classroom teaching
Evaluation
Checking for student understanding during interactive teaching'
Testing student understanding at the end of lessons or units
Evaluating one's own performance, and adjusting for experience
Reflection
Reviewing, reconstructing, reenacting and critically analyzing one's own and the class's performance, and grounding explanations in evidence
New Comprehension
Of purposes, subject matter, students, teaching, and self
Consolidation of new understandings, and learnings [*sic*] from experience

Note. Taken from Shulman (1987) page 15

Likewise, Hattie (2002) has identified five major dimensions of excellent teachers based on the result of classroom observations of expert teachers and experienced teachers from an extensive review of literature and synthesis of many studies. Data based on classroom observations of expert and experienced teachers were collected over an

Table 2

Prototypic Attributes of Teacher Expertise

A. Identifying essential representations of their subject(s)
A1. Expert teachers have deeper representations about teaching and learning
A2. Expert teachers adopt a problem-solving stance to their work
A3. Expert teachers can anticipate, plan, and improvise as required by the situation
A4. Expert teachers are better decision-makers and can identify what decisions are important and which are less important decisions
B. *Guiding learning through classroom Interactions*
B5. Expert teachers are proficient at creating an optimal classroom climate for learning
B6. Expert teachers have a multi-dimensionally complex perception of classroom situation
B7. Expert teachers are more context-dependent and have high situation cognition
C. *Monitoring learning and providing feedback*
C8. Expert teachers are more adept at monitoring student problems and assessing their level of understanding and progress, and they provide much more relevant, useful feedback
C9. Expert teachers are more adept at developing and testing hypotheses about learning difficulties or instructional strategies
C10. Expert teachers are more automatic
D. Attending to affective attributes
D11. Expert teachers have high respect for students
D12. Expert teachers are passionate about teaching and learning
E. *Influencing student outcomes*
E13. Expert teachers engage students in learning and develop in their students' self-regulation, involvement in mastery learning, enhanced self-efficacy, and self-esteem as learners
E14. Expert teachers provide appropriate challenging tasks and goals for students
E15. Expert teachers have positive influences on students' achievement
E16. Expert teachers enhance surface and deep learning

Note. Modified from Hattie (2002)

extended time period and coded. The results indicate that expert teachers possess the abilities to: a) identify essential representations of their subject, b) guide learning through class interactions, c) monitor learning and provide feedback, d) attend to affective attributes, and e) influence student outcomes. These five major dimensions can be sub-categorized into sixteen (16) prototypic attributes of expertise (*see* Table 2).

The acquisition of different levels of knowledge involves different levels of cognition or learning. Therefore, for novices to acquire the expertise that experts have acquired, they need to go through different phases or levels of learning.

Phases/Levels of Learning

Shuell (1990) proposes that "the nature of the learning process changes as the task of mastering a complex body of knowledge unfolds" (p. 531) because learning is "an active, constructive, cumulative, and goal-oriented process" (p. 532). Analysis of expert-novice difference reveals that experts and novices in a certain field respond to a task in fundamentally different ways. According to Chi, Glaser and Rees (1982), experts demonstrate understanding of that knowledge so well that they are able to respond to a task in ways that are more-or-less automatic. Novices, on the other hand, primarily memorize isolated facts when they encounter a new field of knowledge because they have not developed a schema to interpret and integrate the various pieces of information they just encountered. As learning progresses, they begin to group and organize the facts into higher order structures.

Therefore, learning is a much more complex process than people realize. The learning process involves various phases. At different phases, the nature of the learning process changes in systematic ways and the variables that function also have different

effects (Shuell, 1990). Moreover, “Learning is not merely an additive process—qualitative, as well as quantitative, changes occur, and qualitative differences are evident in both the substance of what is being learned and in the learning processes most appropriate for acquiring additional knowledge” (Shuell, 1990, p. 540)

According to Shuell (1990), learners go through three phases in their learning about a subject: the initial phase, the intermediate phase, and the terminal phase. During the initial phase of learning, novice learners memorize isolated facts and pieces of information, and use pre-existing schemata to interpret the isolated pieces of data. They make comparisons and contrasts, trying to find analogies that appear to be relevant. The knowledge acquired during this stage is more concrete and context-dependent than abstract and context-free. Although novice learners begin to develop concept learning, they have not acquired sufficient information to reach more complex forms of learning. With the help of their prior knowledge, novice learners begin to identify both the similarities and differences of the newly acquired information and make connections among the conceptually isolated pieces of information, thus forming an overview about what the new domain is about.

During the intermediate phase, as the relationships of the acquired knowledge are better developed, they are organized into higher-order structures and networks. Thus, new schemata are formed, which render the learners more conceptual power. These new structures and schemata, however, are not fully developed to allow the learners to function on an autonomous, or automatic, basis. During this phase, the knowledge is extended as learners apply it to new situations. They learn by doing as well as by reflecting on the feedback generated from the trial of the new knowledge into various

situations. During the last or the terminal phase of learning, the knowledge structure and schemata that are formed during the intermediate phase are better integrated into other existing schemata and are functioning more automatically. Learning that occurs at this stage is usually addition of new facts to pre-existing schemata and increase of higher level of interrelationships, where schemata consists of other schemata rather than facts (Shuell, 1990).

> Although many cognitive theorists seem to accept the notion of phases in meaningful learning, there have been few systematic attempts to explore the issue in depth. Most of the empirical evidence on stages of learning deals with simpler forms of learning. Although the evidence of phases in long-term meaningful learning is not as convincing at present as one would like, there is good reason to postulate their presence. (p. 532)

Shuell (1990) also argues that learning does not naturally progress from one phase to another. Certain things must be done to ensure the transition from a lower phase to a higher phase. "Unfortunately, these things often are missing from an educational system that emphasizes the accumulation of more and more factual information—that is, an additive model of learning" (p. 542). What seems to be more problematic is that "we currently have a very poor understanding of how these transitions occur and what factors precipitate them" (p. 542).

> What, for example, is the nature of the change that occurs as one moves from one phase to the next? And what factors lead to the changes that are purported to occur? To many people, phases suggest the presence of separate and distinct entities with clear-cut boundaries between adjoining stages. But it seems unlikely that such is the case. It probably is best to think of learning as a continuous process; the boundaries between phases are most likely fuzzy, and the transition between phases gradual rather than dichotomous. (Shuell, 1990, p. 543)

To solve the problem, Shuell (1990) suggested that researchers in educational context investigate whether the transitions between phases can be stimulated or

encouraged. He emphasized that “much more evidence is needed if the existence of phases is to be established in a scientifically valid manner” (Shuell, 1990, p. 544).

Part of this question seems to have been answered by Korthagen and Lagerwerf (1995), who also identified three fundamentally different levels in the process of learning a subject—image formation level, schematization level, and theory building level. The first level of learning is the formation of an image that comes out of a range of familiar examples or experiences. The second level of learning is the formation of the schema based on the images, which includes all kinds of interrelated details. The third level of learning is the development of a theory that consists of basic assumptions, definitions, and logical inferences (Korthagen & Lagerwerf, 1995).

As Korthagen and Lagerwerf (1995) put it, people construct all kinds of personal images they encounter in everyday experiences. These personal images are then associated based on their similarities and differences, forming networks of relationships, called schemata. Schematization, or the process of forming schemata, is originated in a need for more clarity. This clarification of the new images and new experiences provides an individual the opportunities to explain and justify what they are doing, and to verify the result. Theory building is originated in a need for the organization of the constructed schemata. It is the logical structuring of the schemata, which helps individuals to organize their schemata into networks that are logically related. To make the transition from one level to another, “people must reflect on the knowledge they have already acquired or the experiences which they have undergone, and strive to introduce into them a new structure” (Korthagen & Lagerwerf, 1995, p. 1028).

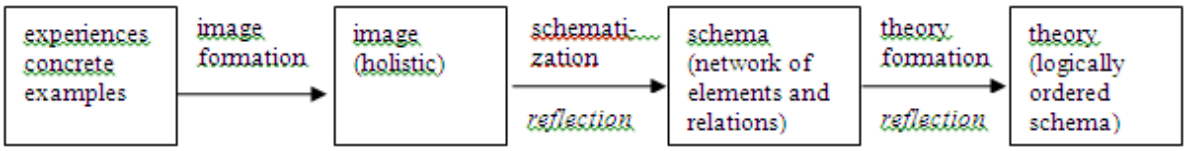

Figure 3. Phases in the Learning Process and the Accompanying Levels

It is important to realize that a level transition means more than just generalization and abstraction. "A level transition is an essential qualitative change in the internal representation of a situation or object in the external world" (Korthagen & Lagerwerf, 1995, p. 1030). At the image level, the image is closely related to some concrete object or situation. As one gains more experience and the number of the related examples increases, an abstract concept of these concrete examples is gradually formed, and the cognitive process from concrete examples to abstract concept is schematization. "This development from concrete to abstract on the image level is a precondition for a level transition" (Korthagen & Lagerwerf, 1995, p. 1030). Similarly, at the schema level, there exists a gradual development from a simple network of connections to a more complex structure, which is also known as rich schema. "The development of a rich schema is a precondition for a correct transition to the theory level" (Korthagen & Lagerwerf, 1995, p. 1030). At the theory level, level transition happens when new structure has been formed. "In the transition between the schema and the theory level, it is essential that the connections from the schema become the elements of a new network of logical relationships and that the logical connections between the new elements are made explicit" (Korthagen & Lagerwerf, 1995, p. 1031), as is illustrated in Figure 3.

Individuals' knowledge about a concept develops from the level of isolated data or facts to the level of contextualized information and ultimately to the level of organized scientific theories (Gadner, et al., 2004). Reflected in the phases and levels of learning

(Korthagen & Lagerwerf, 1995; Shuell, 1990), the knowledge at each level is acquired at a corresponding phase or level of learning that involves different complexity and cognitive tasks (*see* Table 3). For example, at the initial phase or image level of learning, novice teachers see isolated facts or images of teaching and learning. Therefore, they may not consider instructional planning and strategies as being related to student learning. Those facts and images are called raw data or pieces of information. At the intermediate or schema level of learning, their knowledge of teaching and learning are more concrete and contextualized, organized in networks of elements and relations. They can realize that instructional planning and strategies affect student learning in certain contexts and begin to make connections among the different elements or components that are related to teaching and learning. These connections or networks are called schemata. At the terminal or theory level of learning, novice teachers' schemata about teaching and learning are integrative and logically ordered. They can organize the interrelated networks of elements of instructions and student learning into networks of schemata or theories that are arranged in a logical order. These logically ordered schemata are called theory.

To sum up, when novice teachers organize their knowledge about teaching and learning into networks of related elements, or when they build their schemata of teaching and learning, they experience the cognitive process of schematization. When they organize their schemata of teaching and learning into related networks of schemata, or when they build their theory about teaching and learning, they experience the cognitive process of theorization.

Table 3

Levels of Knowledge versus Phases and Levels of Learning

Levels of Knowledge (Gadner, et al., 2004)	Phases of Learning (Shuell, 1990)	Levels of Learning (Korthagen & Lagerwerf, 1995)
Data and facts (raw, incomprehensive)	Initial (isolated facts and pieces of information)	Image or Gestalt (holistic)
Information (Contextualized, but unevaluated)	Intermediate (concrete, contextualized)	Schema (network of elements and relations)
Scientific theories (organized, ultimate)	Terminal (integrative schemata and theory)	Theory (logically ordered schemata)

As can be seen, during the different stage of novice teachers' knowledge and schemata development, their teaching and prior learning experiences and their reflection on the previous experiences play an essential role. It is through reflection that novice teachers look into their concerns and gain a better understanding of their teaching – a focus of reflective learning.

Reflective Learning

Reflection is conceived as a learning process, where learners reflect on their lived experience and then interpret and generalize this experience to form mental structures.

> The structures are knowledge, stored in memory as concepts that can be represented, expressed, and transferred to new situations. Explanations in this perspective inquire into ways people attend to and perceive experience, interpret and categorize it as concepts, and then continue adapting or transforming their conceptual structures or "meaning perspectives". (Mezirow, 1990, as cited in Cochran-Smith & Lytle, 1999; Putnam & Borko, 2000)

In other words, learners are believed to construct, through reflection, a personal understanding of relevant structures of meaning derived from their action in the world

(Fenwick, 2000). During the reflection process, learners notice and reframe problems of their interest in particular ways, thus forming, reforming and transforming schemata.

Reflective practice plays an invaluable role in teachers' learning and professional development (Dewey, 1933; Schön, 1983, 1987; van Manen, 1977). Teachers' reflective actions refer to the "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends" (Dewey, 1933, p. 9). In other words, reflectivity is self-awareness or the ability to see oneself as an object in the field of education as well as most academic inquiry. The self plays two roles – both the subject-who-reflects and the object-who-is-reflected-upon (Nadler, 1989). In addition, reflection is also the ability to make deliberate choices (van Manen, 1991):

> Reflection is a fundamental concept in educational theory, and in some sense it is just another word for 'thinking.' To reflect is to think. But reflection in the field of education carries the connotation of deliberation, of making choices, of coming to decision about alternative courses of action. (p. 98)

Research has shown that teachers' teaching improves when they actively reflect on their teaching practice (Schön, 1987; Zeichner & Liston, 1987). Most research about teacher reflective learning focus on teacher reflection in terms of types and time frame of reflection.

van Manen's (1977) three types of reflection (technical, contextual, and critical) are commonly used as a criteria to assess teachers' reflection. The focus of technical reflection is the application of knowledge and skills to reach a given goal. Contextual reflection focuses on analyzing and clarifying meaning, practices, assumptions, and perceptions underlying practical actions. Critical reflection, assumed by some people to be the highest level of reflection (Zeichner & Liston, 1987) and the ultimate goal of the

reflective practice in teacher education, emphasizes questioning critically the moral, ethical and political aspects of teaching and learning (Tsangaridou & Siedentop, 1995; Zeichner & Liston, 1987).

Based on van Manen's (1977) criteria of reflection, Sparks-Langer & Colton (1991) produced a framework that has been used extensively for assessing novice teachers' reflective thinking. This framework "has seven levels: (1) no description; (2) simple, layperson description; (3) labeling of events with pedagogical concepts; (4) explanation using only tradition or personal preference; (5) explanation using pedagogical principles; (6) explanation using pedagogical principles and context; and (7) explanation with ethical/moral considerations. Sparks-Langer & Colton's (1991) levels of reflection has been expanded by other researchers. For example, a rubric was developed by Calandra, et al., (2006) and has been used to assess novice teachers' levels of reflective language as well as their thinking demonstrated in their reflections (*see* Table 4).

Based on the time frame, reflections can be categorized into reflection-in-action, reflection-on-action, and reflection-for-action (Killion & LaRocco, 2006; Schön, 1983, 1987). Reflection-in-action refers to reflection on the spot, or when an event is happening, while reflection-on-action refers to reflection after the event has occurred. Both reflections in and on action involves retrospection, examination and evaluation of the event or experience, feelings involved, use of theories employed, and the motivations and rationale for the action taken. (Schön, 1983, 1987). Reflection-for-action means reflection not only on the past, but also for the future. "We undertake reflection, not so much to revisit the past or to become aware of the metacognitive process one is

Table 4

Rubric for Levels of Reflective Language and Thinking

Level	Description
1	*No descriptive language*
2	*Simple, layperson description* ("I used groups.")
3	*Events labeled with appropriate terms* ("I tried peer-response groups in writing workshops.")
4	*Explanation with tradition or personal preference given as the rationale* ("I always use peer-response groups for a longer writing assignment because I like how we did that in class in this program.")
5	*Explanation with principle or theory and consideration given as rationale* ("Peer-response groups help students get out of the proofreading/correcting mode and help them focus on revising their whole paper so they can continue writing and make the whole paper better.")
6	*Explanation with principle/theory and consideration of context factors* ("I think the peer-response groups are useful in this class because the students in my school are not used to working together in groups, and I want to teach them how to do this.")
7	*Explanation with consideration of ethical, moral, political issues* ("Because these students tend to segregate themselves in groups by gender, I think the peer-response groups will help them learn to accept and value each other's perspectives")

experiencing…, but to guide future action (the more practical purpose) (Killion & LaRocco, 2006, p. 15).

Although named differently, van Manen (1991) also describes the time frame of reflection: reflection that looks at the past, present and future. Retrospective reflection takes the past action as its focus. The contemporaneous reflection focuses on the present actions. The anticipatory reflection revolves around future actions. More recently, Calandra and Puvirajah (2011) have also proposed the idea of immersive reflection, a technologically enhanced process, claiming that "immersive reflection involves a

teacher revisiting a teaching experience in a realistic, visually rich form, slowing it down, rewinding it, discussing it with peers and mentors, and thinking about how to make positive changes to it" (p. 34).

One core concept of reflection that has prevailed in the literature is that teachers use logical, rational, step-by-step analysis to examine their teaching and the contexts in which the teaching happens (Fox, et al., 2007). The logical, rational, step-by-step analysis is believed to help novice teachers better understand their teaching practices; thus constructing and restructuring their professional knowledge. "Although this conceptualization of reflection is important and has undoubtedly proven successful in promoting the professional development of teachers, it describes only one way in which the human mind can process information and direct decision-making"(Korthagen, 1993, p. 317). Novice teachers do not always use the "logical" and "analytical" mode of reflection to process the complex information that is happening in the classroom. Another mode of reflection is "a-rational" and "a-critical", making use of "gestalt" or "image" to interpret data and make decisions in the classroom. An understanding of novice teachers' gestalt-based actions can help teacher educators use the right strategies to help novice teachers develop professionally (Korthagen, 1993).

A major debate in educational theory and practice focuses on how reflection-on-experience unfolds in different contexts to create knowledge. Learning is presented as a reflection-action (or mind-body and individual-context) binary: recalling and analyzing lived experience to create mental knowledge structures (Berliner, 1988) and action (Kolb, 1984).

Kolb (1984), through his experiential learning theory, argues that individuals acquire knowledge from their experience through observations and interactions with the learning environment, mearning that their meaning-making process is through reflection on what they have done. In other words, learning is considered as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it" (Kolb, 1984, p. 41). Expertise is developed as a result of reflective actions, inlcuding describing, explaining, and evaluating thinking (Hammersley, 1992; Mason, 1996).

Experiential learning theory is a holistic integrative perspective on learning, combining experience, perception, cognition, and behavior. From the perspective of experiential learning theory, learning is considered as a continuous process of generating knowledge that is grounded in experience (Kolb, 1984). To obtain knowledge, learners must be able to actively involve themselves in the experience, reflect on the experience, conceptualize the experience; and use the new ideas gained from the experience. In addition, they need to have four kinds of abilities to become effective learners, including:

> Concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualization abilities (AE), and active experimentation (AE) abilities. That is, they must be able to involve themselves fully, openly, and without bias in new experience (CE). They must be able to reflect on and observe their experiences from many perspectives (RO). They must be able to create concepts that integrate their observations into logically sound theories (AC), and they must be able to use these theories to make decisions and solve problems (AE). (Kolb, 1984, p. 30)

The development of the different kinds of abilities is a process of resolution of tension and of conflicts as concrete experience and abstract conceptualization, and active experimentation and reflective observations are two sets of extremes. During the learning

Table 5

Novice Teachers' Developmental Stages

Fuller (Fuller, 1990)		**Kwo** (Kwo, 1996)	
Stages 0-1	Focus on self	Stage 1	Hold idealistic view about teaching and learning
		Stage 2	Focus on immediate concern for survival, class control, desire to fit in school
Stages 2-3	Focus on class control and relationship with students	Stage 3	Focus on establishing authority as a teacher, developing teaching strategies
		Stage 4	Focus on students' learning
Stages 4-6	Focus on student learning and progression	Stage 5	Focus on developing a deeper understanding of teaching and learning

process, "one moves in varying degrees from actor to observer, and from specific involvement to general analytic detachment". It is the way in which the conflicts are resolved that determines "the level of learning that results" (Kolb, 1984, p. 31) and that differentiates the novice from the expert (Korthagen & Lagerwerf, 1995; Shuell, 1990).

Fuller (1990) and Kwo (1996) also emphasized the importance of reflection in novice teachers' professional development, stating that novice teachers benefit from their reflection on practice at each stage; however, the nature and content of the reflection are different based on their experience. They assessed novice teachers' developmental stages by examining the foci of their reflections (*see* Table 5).

Figure 4 presents Kolb's (1984) experiential learning cycle combined with the time frame of reflection. As Figure 4 illustrates, reflection-on-action links the concrete experience and the forming of the abstract concepts stages together. The "forming abstract concept" stage is where schemata are constructed. To elaborate, this reflection-

on-reflection (RoA) or sometimes reflection-in-action (RiA) process is an inductive process in which novice teachers link their concrete teaching experience with the theories of teaching and learning by schematization. Meanwhile, novice teachers decide on the actions they will take in similar situations in the future or reflection-for-action (RfA). This RfA process is a deductive process where ideally novice teachers use theories of teaching and learning to guide their future actions, or linking theories back to concrete teaching experience. The new concrete experience, however, is not just a repetition of the same experience that has previously happened. Rather, it is an action that is made based on the decision after a thorough consideration of what has happened in prior experiences.

A newer line of research about teacher reflective practice indicates that personal reflection in and on action (Killion & LaRocco, 2006, p. 15) has proven to be a central focus for making change among teachers because these types of reflection not only focus on one's own actions, but also play an important part in determining whether teachers would like to make changes to their teaching practice. This type of reflection is a synthesis of theory and practice (Schön, 1983), which creates moments of tension and perturbation in novice teachers' personal beliefs. According to Yerrick, Ross, and Molebash (2005), the importance of personal reflection in and on action is to offer instances of cognitive and even emotional disequilibrium that engage students in seeing themselves. In other words, when teachers reflect in such a way, they are trying to explain their reasoning and defend their practice with current learning theory, which may lead to the development of their understanding and readiness for acting.

Literature also indicates that cognitive elements play an important part in teachers' reflective teaching. The cognitive elements of teacher reflective practice focus

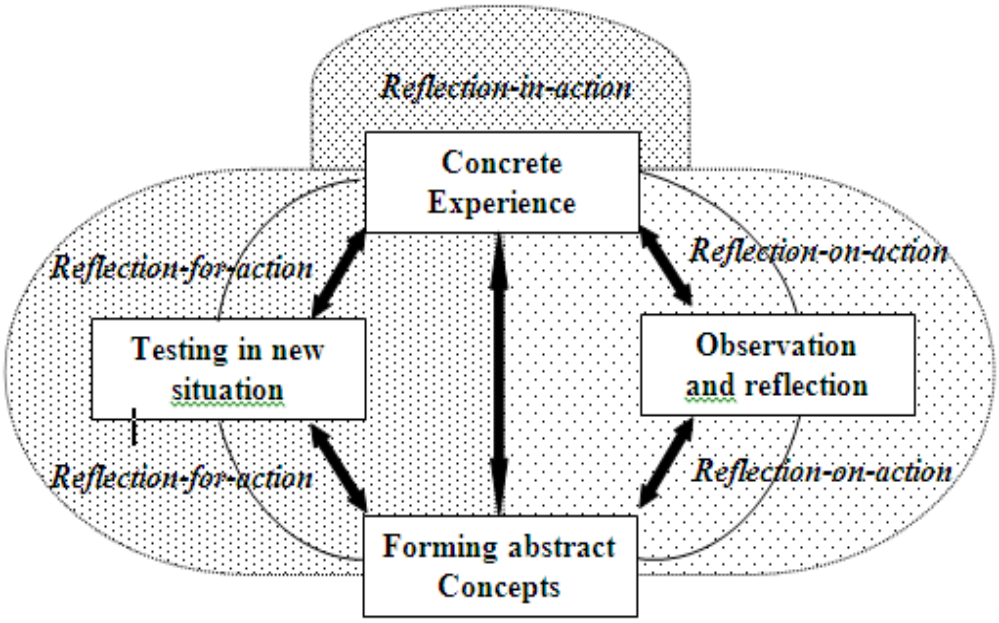

Figure 4. Types of Reflection and Experiential Learning

on "how teachers process information and make decisions" (Sparks-Langer & Colton, 1991, p. 37). The cognitive elements of teacher reflection describe how teachers use knowledge in their planning and decision making. Sparks-Langer and Colton (1991) claim that most research about the cognitive elements of teacher reflection revolve around content or subject-matter knowledge, pedagogical methods and theory, curriculum and characteristics of learners. Another focus of cognitive reflective research centers on how their knowledge base is organized. Researchers are interested in how information is organized into a network of related facts, concepts, generalized structures, that constitute the individual's comprehension of the world and allow a large body of information to be stored and accessed very rapidly (Sparks-Langer & Colton, 1991). This network is also known as schemata.

In sum, human learning is a process that involves constant absorption of new experience, reflection on the newly absorbed experience, and the association to existing knowledge. The experience that human beings go through is a dynamic process as each

experience they have will impact their future experiences. Reflection is the process that leads to meaningful and transformative learning (Kolb, 1984; Schön, 1983). In addition, learning is a much more complex process than most people have realized, and "the nature of the learning process changes as the task of mastering a complex body of knowledge unfolds" (Korthagen, 1993, p. 317). Although the knowledge base about knowledge and learning has expanded greatly, some basic questions concerning the nature of knowledge and learning remain unanswered (Shuell, 1990, p. 531). One of the questions is

> How do images relate to more logically structured cognition? Can these two types of knowledge coexist, and can this also be the case when they are in fact contradictory? How do images develop and change? What does it mean to "reframe" experiences and to change "misconceptions"? And, last but not least, how do cognition, in whatever form they exist, relate to feelings and actions? (Korthagen & Lagerwerf, 1995, p. 1011-12)

Therefore, to find an answer to this question in the field of teacher education will undoubtedly inform educational programs and educators of what they can do in order to help novice teachers learn from reflecting on their teaching practices.

Related Empirical Studies

According to Goldman (2003), the goal of the first-generation of multimedia use was to enhance learning through demonstrating the complexity of the presented content by the dynamic use of multimedia. The second-generation multimedia use has shifted its focus to media-enabled affordance that supports active processing of knowledge construction and reasoning. Lajoie and Nakamura (2005) recommended a third-generation use of multimedia that aims at fostering higher degrees of interactivity with more varied types of media. Jonassen and Reeves (1996) argue that multimedia use in education can help learners learn both "from" and "with" media technology. When

learners learn from technology, technology only serves as a tool that delivers the knowledge, such as video technology that is used for direct instructions in teaching novice teachers the steps of procedure of teaching. When learners learn with technology, this technology becomes a cognitive tool. A cognitive tool refers to technology that enhances the cognitive powers of human beings during thinking, problem-solving, and learning. When used as cognitive tools, media and technology provide learners a means to record and analyze the world, access and interpret information, organize their personal knowledge, represent what they know to others, and help themselves develop a level of mental process needed to complete a task. Video technology, if used appropriately, can become a powerful cognitive tool.

Use of Video in a Reflective Mode

"Video within research is a process and a product" (Haw & Hadfield, 2011, p. 141). Video has been used mainly in five modalities in research – extraction, articulation, participation, reflection and provocation. Video, used in an extraction modality, can record a specific interaction for a more in-depth study by the researcher. Video, used in a reflection modality, can support participants to reflect on their actions, understandings and constructions. Video, used in a provocation modality, can provoke participants to critically examine and challenge existing norms, traditions and power structures. Video, used in an articulation modality, can help participants voice their opinions and communicate these to others (Haw & Hadfield, 2011). "The use of video to support participants to reflect is one of the widest-ranging modalities, covering various research formats and disciplines" (Haw & Hadfield, 2011, p. 146). When used in a reflective mode, video is compared to a mirror, from which observers can either stand back and

look at themselves, or move closer to the image and examine from particular angle. Thus, like a mirror, video provides the following potentials when it is used in a reflective modality:

- Video can present various 'objective' image of the participant back to themselves, either self-generated or by others – who holds the mirror up to the observer?
- Video technology means that a wide range of participant activities, across a variety of contexts, can be reflected upon in various combinations – the mirror as a reflection of a changing self.
- Video allows an observer repeatedly to explore an image from different directions and varying proximities, thus allowing them to consciously shift their focus as they reflect – mirrors that can provide a full-length 360^{o} image and detailed close-ups.
- The video image shown to participants can be designed so as to present alternative or contradictory 'images' of themselves and challenge their current conceptions – the distorted mirror that exaggerates or shrinks key features
- Video can present to participants their own image set alongside those of others, which they can then reflect on individually or with others – the hall of mirrors. (Haw & Hadfield, 2011, p. 51-52)

Video used in a reflective modality is believed to provide prompts for reflection due to the moving visual images, helping observers deepen their self-reflection and self-knowledge. Furthermore, different kinds of reflective activities help observers make connections "between action and knowledge, aspects of self, and the individual and their context. Reflection is essentially concerned with participants either establishing new connections or changing existing ones" (Haw & Hadfield, 2011, p. 53).

Use of Video as a Reflective Tool in Teacher Education

Most research of digital video technology in teacher education focuses on fostering analysis and reflection on teaching practices (Girod, et al., 2007). According to Spiro, Collins, and Ramchandran (2007), digital video technology, if used appropriately, can become a cognitive tool that promotes deep learning, which can lead to conceptual

mastery and preparation to apply knowledge to complex and ill-structured domains. It encourages learners to look harder, look again and expect to find more.

Video technology has the affordance to capture the complexity and reality of the classroom in order to allow teachers to review the captured video for in-depth analysis and reflection (van Es & Sherin, 2002; Wang & Hartley, 2003). Both research and practice have shown that the video-based activities can deepen novice teachers' reflection and facilitate the development of reflective pedagogy (Fadde, Aud, & Gilbert, 2009). Video is an important tool to help novice teachers become reflective practitioners who constantly evaluate the effects of their decisions and actions in teaching (McLaughlin & Vogg, 1998). Reviewing and discussing video recorded segments can also help novice teachers make connections between what they have learned in their teacher education classes with what they see on the videos, thus providing multiple opportunities for reflection (Kasten & Ferraro, 1995; Miels, 1999).

The use of video for reflective purpose can find its root in the belief that moving visual images promote reflections and engage different and deeper reflective acts normally falling into the category of self-reflection and self-knowledge (Haw & Hadfield, 2011). Video recording one's own teaching is a common practice used in teacher preparation programs to promote reflection. The advancement of new technologies has created a new range of possibilities for teaching, learning, and professional development. Using video technology for teacher professional development is not a new idea or practice. Studies about video technology indicate that this technology can provide a means to capture the complexity and reality of the classroom while allowing time for analysis and reflection that cannot be achieved through observation alone (van Es &

Sherin, 2002; Wang & Hartley, 2003). Furthermore, digital video technology is often used as a visualizing and reflecting tool on teachers' thinking because it can provide a better visualization than most other media, such as written documentation and photographs (Hong & Broderick, 2003).

Another possibility that digital video technology incurs is the interactivity between novice teachers and the learning environment. Learning environments that involve the use of digital video technology can be effective to "engage learners in relevant cognitive processes" (Wouters, et al., 2007, p. 327). Due to the affordances that digital video technology provide for the educational purposes, one of the major areas of research on digital video technology in teacher preparation and teacher professional development focuses on using video technology to foster analysis and reflection on teaching practices. Teachers can watch videos of their own or others' teaching, analyze and critique what they saw in the videos, and learn more sophisticated pedagogy or deepen understanding of teaching actions (Girod, et al., 2007).

Novice teachers watch themselves teach, analyze and critique the video footage of the teaching practices in order to gain a better understanding of the complex context, sophisticated pedagogy and teaching practice (Brantley-Dias, et al., 2008; Calandra & Brantley-Dias, 2010; Calandra, et al., 2007; Calandra, et al., 2009; Calandra, et al., 2006; Calandra, Gurvitch, & Lund, 2008; Calandra & Puvirajah, 2011; Capraro, Capraro, & Lamb, 2001; Finn, 2002). This process of observation, analysis and critique is termed as self-observation based learning. Self-observation based learning involves re-exposing individuals to their own self-generated behaviors, which usually involves showing individuals past generated behaviors through a host of media, such as video

recordings (Osman, 2007). Despite the increasing research interest in how novice teachers learn from their experience using digital video technology, and the proven usefulness of video technology in fostering analysis and reflection, there has been little research that examines novice teachers' cognitive process in reviewing, analyzing, and reflecting on the videos of their own practical teaching and how the process might have helped them to construct the expertise of teaching or to construct their professional content knowledge.

VAST

I have developed VAST and used it as the theoretical framework for this study. VAST, acronym of video-aided schematization and theorization describes the cognitive processes that novice teachers experience while they watch the videos of their teaching. As discussed earlier, we organize our knowledge about specific stimuli or events, which we acquired from our action in the world, into a network of schemata. Our schemata guide our processing of new information and our retrieval of stored information, which is also called existing knowledge or schemata. In other words, schema is considered as our general knowledge, organized in categories or rules and stored in our memory, which are not necessarily in hierarchical order, but are supposedly in connected networks. The schemata of each of us are unique because they are developed based on our own experiences. Our schemata are also situation-specific; therefore, experts handle the same situation better than novices because they have a more complex developed schemata (Anderson, 1977; Widmayer, 2011).

Our schemata are developed from our everyday experiences, which in turn guide our behavior in familiar or even unfamiliar situations. In addition, they grow from a

simple network into a more complex structure with our reflections on our experience. Our learning is a process that involves constant absorption of new experience, reflection on the newly absorbed experience, and the association to existing knowledge. The experience that we go through is a dynamic process because each experience we have will impact our future experiences (Fenwick, 2000; Kolb, 1984; Shulman, 1987).

Our schemata change when new information is assimilated or accommodated into our existing schemata when we adapt our existing schemata to fit the new information, or when we create new schema to hold the new information. Thus, schemata are also called slots or placeholders of new information that we acquired from our experience. We modify our schemata whenever we process the new information that we experience (Widmayer, 2011). We construct our schemata by schema accretion, schema tuning, and schema restructuring.

Some factors that affect the encoding of new information into our schemata are attention, constant exposures to experiences, and reflection (Anderson & Pichert, 1978; Driscoll, 1994; Korthagen & Lagerwerf, 1995). We construct our schemata through reflecting on our experience and our actions with the world. Our knowledge, in turn, guides our decision-making and our action with the world. Therefore, experience, reflection, knowledge construction and action are interrelated.

Literature indicates that cognitive elements play a key role in teachers' reflective teaching. The cognitive elements of teachers' reflective practice focus not only on how they process information, but also on how they make decisions. The cognitive element of teacher reflection describes how teachers use knowledge in their planning and decision-

making. Most of the research on teachers' cognitive elements has focused on content or on how their knowledge is organized (Sparks-Langer & Colton, 1991, p. 37).

Literature has indicates that video technology has the affordance to provide novice teachers with the details of their video-captured teaching practice that they can look at again and reflect on. During the reviewing and reflection process, novice teachers search for the critical incidents that they either assimilate or accommodate into their schemata about teaching and learning. With a fully or more complex developed schemata, novice teachers are able to better handle their everyday teaching. The development towards expert schemata will eventually equip novice teachers with the knowledge and skills to improve their teaching behavior and be able to react automatically and successfully to different situations in their teaching.

Video technology can help novice teachers deepen their reflection and knowledge construction due to the affordances it offers. The focus of research on video-enhanced reflection are beginning to shift from focusing on promoting novice teachers' levels of reflection to focus on training novice teachers to focus on the content and pedagogy of their practice teaching, and "increase the metacognitive monitoring process that appears to be central to learning, thereby increasing confidence and performance" (Webb, Diana, Luft, Brooks, & Brenna, 1997, p. 97).

That being said, research findings that examine novice teachers' cognitive elements evidenced in their reflection when they review the videos of their teaching practice should be useful for teacher education program and educators. To examine novice teachers' video-aided cognitive processes, particularly those related to their knowledge construction, restructuring, and reconstruction, or their schema construction, I

developed a theoretical framework for this study, called VAST, the acronym for Video-Aided Schematization and Theorization. The development of VAST is informed by related theories and research, such as schema theory, phases/levels of learning, and reflective learning.

What I did was to use VAST to measure novice teachers' schema change that was detected in their critical incidents reflection (CIR) forms. Their schema changes were described and illustrated in terms of schema accretion, schema tuning, and schema restructuring together with the focus of their reflection evidenced in their CIR forms. The figure that shows what information novice teachers paid attention to in their video-aided reflection and how that information was organized with other schema in their mind is similar to the illustration of the egg schema (see Figure 1).

Summary and Overview

This chapter is a review of literature that informed the development of the theoretical framework: VAST. The relevant theories and research includes schema theory, levels/phases of learning, reflective learning, and research about the use of video in teacher education. VAST was used to investigate novice teachers' schematization and theorization processes while they were reviewing and reflecting on the videos of their teaching. Novice teachers' VAST was examined by looking at their schema change, such as schema accretion, schema tuning and schema restructuring.

The next section of this study, Chapter 3, is a description of the methodology employed in this study that has been used to answer the research questions, the context, participants, and sampling, the data sources, collection and management, data analysis, trustworthiness, and the limitations of the research methodology.

CHAPTER 3

METHODOLOGY

Introduction

Although many studies have investigated novice teachers' video-aided reflection on their teaching experience, few studies have explored their cognitive processes in terms of how they construct, restructure, and reconstruct their knowledge about teaching and learning, or the schematization and theorization of their knowledge during their reflection. This study was informed by qualitative perspectives because they provide a valid way to gain new insights into issues that have been insufficiently studied (Creswell, 1998) – a focus of this study: novice teachers' video-aided schematization and theorization in their reflection of their teaching. Furthermore, qualitative research focuses on understanding human experience involved in the process by which they construct the meaning of the world around them as well as what the meanings are (Patton, 1985) – a focus of this study as well: how novice teachers develop their knowledge about teaching and learning in their reflection on their teaching experiences.

In this chapter, I first discuss the research approach and why it was adopted in this study. Next, I describe the context, participants, sampling, data sources, collection, and management, and data analysis. Lastly, I elaborate on the trustworthiness and limitations of this research.

Research Method

The research method adopted for this study is a qualitative case study approach, which shares the characteristics of both a basic interpretative qualitative study and a case

study. The selection of the research method is based on the nature of this study and the research questions. It was also informed by prior studies that are relevant to this research. A qualitative case study was an appropriate research approach for this study because of the following reasons.

First, a basic interpretive qualitative approach aims at "learning how individuals experience and interact with their social world, the meaning it has for them" (Merriam, 2002b, p. 4). According to Bazeley (Bazeley, 2007, p. 2),

> Qualitative methods will be chosen in situations where a detailed understanding of a process or experience is wanted, where more information is needed to determine the exact nature of the issue being investigated, or where the only information available is non-numeric (e.g., text or visual) form. Such investigations typically necessitate gathering intensive and/or extensive information from a purposively derived sample, and they involve interpretation of unstructured or semi-structured data. (Bazeley, 2007, p. 2)

Furthermore, a qualitative research perspective is adopted in exploring the research questions because a qualitative method usually helps to discover and understand phenomena, processes, people's perspectives and view of the world through the analysis of data (Denzin & Lincoln, 1994). The purpose of this study was to understand novice teachers' foci of their video-aided reflection and the cognitive processes involved in reviewing the videos of their teaching through the examination of their critical incidents reflection (CIR) forms – a type of non-numeric information. It also aimed at exploring how novice teachers learned from their teaching experiences, interacted with the videos of their teaching, and how they made meaning out of the process. In addition, a qualitative perspective was appropriate in finding answer to the "what" and "how" types of questions explored in this research because a case study inquiry tend to address the

"how" or "why" questions within a real-life situation (di Gregorio & Davidson, 2008). Therefore, a basic interpretive qualitative approach is appropriate for this study.

Second, a case study also has the characteristics of being particularistic, descriptive, and heuristic. It is usually designed to describe a group or scene as a whole, and to answer a particular question (Goetz & LeCompte, 1984, p. 2). One of the reasons for conducting a qualitative study is "because there is a lack of theory or an existing theory to adequately explain a phenomenon" (Merriam, 2002b, p. 5). In addition, a case study required the investigators to define a case boundary and selecting a unit of analysis, which is related to the research questions and the focus of the study (Merriam, 1991; Yin, 2003).

This study was to explore novice teachers' VAST where the situation of each participant was unique in regard to their beliefs, prior knowledge, background and experiences that were related to teaching, learning and life. In addition, novice teachers varied in terms of age, gender, ethnicity, background, teaching experiences, prior knowledge and beliefs about teaching and learning. An in-depth examination and detailed description could help reveal the meaning they constructed about their world and their experience; namely, how they made sense of their experience (Merriam, 2002b). Moreover, there is no existing theory to adequately explain novice teachers' cognitive processes involved in their video-aided reflection. The bounded system that made the case was determined by the location or the program as well as by the time: novice teachers enrolled in a teacher education program at a large urban university in the southeastern United States during Fall 2010 and Spring 2011. Furthermore, for a better understanding of the experience that novice teachers went through in their VAST

process, the issue was best examined from the participants' perspective, such as what problems they focused on in their reflecting on their teaching experience, how they constructed the meaning, or how they built the schemata and theory about teaching and learning through re-living the situation aided by video editing technology.

Lastly, most case study studies in education are qualitative and hypothesis-generating, designed to build theory, not to test theory. For example, Savenye and Robinson (2004) explains how a case study can be used in technology-enhanced teacher education,

> Researchers often conduct a case study to learn more unobtrusively about students, teachers, and trainers who use a new technology. Case studies present detailed data that create a picture of perceptions, use, attitudes, reactions, and learner/teacher environments. Case study cannot be generalized; however, they may be used to derive questions later to be investigated in an experiment. (pp. 1047-8)

Related empirical studies also informed the selection of the methodology of this study. Most of the empirical studies that are related to this study use qualitative research methods, including basic interpretative qualitative study, qualitative case study, qualitative content analysis, grounded theory, and/or a combination of these research methods, as described in the earlier section of this literature review (Calandra & Brantley-Dias, 2010; Calandra, et al., 2009; Calandra, et al., 2006; Calandra, et al., 2008; Fadde, et al., 2009; Fox, et al., 2007; Girod, et al., 2007; Potter, 2006)

A pilot study was conducted to test the procedure, the theoretical framework – VAST, the methodology used in this dissertation. The findings of the pilot study were used as the basis for refining the research method used in this dissertation.

Context, Participants, and Sampling

The context of this study was an undergraduate science education program at a large metropolitan state institution in the southeastern United States. One of the goals of the class was to engage students in activities that were designed to improve students' reflective practice. Accordingly, participants were required to video-record two sessions of their teaching in Fall 2011. One of these was their peer teaching session, and the other one was their practicum teaching session. They were also required to reflect on those videos of their teaching using the critical incidents reflection (CIR) forms (*see* Appendix I). They did a similar assignment for another one of their Methods class in Spring 2012. The video-aided reflections, or the CIR forms, were part of the participants' course work, which they were required to complete for their undergraduate study at the teacher education program.

The sampling used in this study was both convenient and purposive. I happened to study for my doctoral degree in the same department where the participants were enrolled in their science Methods classes. With the help of the instructors of both of the classes that the participants were enrolled, I was able to collect the participants' course work, namely their CIR forms as data for my research. The original sample consisted of 15 undergraduate students who were enrolled in the science Methods class in Fall 2011, with four being purposively excluded due to incomplete data or data saturation; thus the sample consisted of 11 participants. One of the excluded participants had only two CIR forms from Fall 2011 and no CIR forms from Spring 2012. Although another participant – Sheryl, also had only two CIR forms from Fall 2011, she was not excluded because she had one CIR form from Spring 2012. In addition, she volunteered to participate in the

interview. Three other participants were also excluded due to data saturation because from my review of their CIR forms little new were added to the themes that had already surfaced. In addition, the CIR forms of other participants that were similar to the excluded participants were more representative.

Eight out of the 11 participants were female, and three were male. The age of the participants varied in a wide range: starting from 18-21 years of age to 61 and above. There were eight White participants, one African-American, one Asian-Pacific Islander, and one participant whose ethnicity was not specified. None of the 11 participants had previous teaching experiences, except for two who had only some substitute teaching

Table 6

Participants Demographics

Participants (Pseudonyms)	Gender	Age	Ethnicity	Year(s) of Teaching Experience	Grade Level(s) Taught	Subject(s) Taught
Becky	F	18-21	White	No	7th	Math
Daisy	F	51-60	White	No	4th	Science
Elliot	M	61 & above	White	No	5th 8th	General Science
Emily	F	51-60	White	No (only sub-teach)	7th	Science Math
Kate	F	22-25	Asian-Pacific Islander	No	6th & 4th	Science Math
Lance	M	41-50	White	No	4th	Social Studies
Mariah	F	31-40	Other	No (only sub-teach)	4th & 6th	English Science
Patricia	F	26-30	White	No	4th	All
Sheryl	F	22-25	African-American	No	6th	Social Studies
Ted	M	26-30	White	No	6th	Science Earth
Teresa	F	41-50	White	No	7th	Life Science

experiences. The grades that the participants had taught were middle grades: from 4th to 8th grade. The subjects they had taught also varied (*see* Table 6).

In Spring 2012, nine out of the 11 participants who had participated in this study again allowed me to collect the CIR forms that they completed in their Methods class as research data. One of the other two participants was not able continue to take part in this study because the school where he was teaching for his practicum practice did not allow him to video-record his teaching. The other participant responded to the invitation e-mail and refused to take part in the study. Five participants agreed to take part in an interview with me individually although I sent e-mails to and called all the 11 participants to invite them for the interview. Pseudonyms were used to protect the participant's credentials as shown in the Table 6 so that their true identity was not recognized.

Data Sources, Collection, and Management

The data sources of this study consisted of documents and interview data, with the documents data being the critical incident reflection (CIR) forms that participants were required to complete as part of their assignments or course work. The CIR forms that participants completed as part of their coursework were collected from both of the Methods classes that the participants were enrolled in: Fall 2011 and Spring 2012. As part of course requirement in the Methods classes, participants took part in various peer-teaching or microteaching experiences and school teaching experiences.

As one of the activities that participants were involved in their Methods classes were to plan, teach, and reflect upon their teaching experience. They were required to video-record their teaching, review the videos of their teaching, choose critical incidents from the videos, and complete a CIR form for each incident identified from the videos. In

Fall 2011, participants recorded two sessions of their teaching using a digital video camera: one of their peer-teaching sessions and one of their school teaching sessions.

The CIR forms were used as the primary source of data. In educational settings, documents are commonly-used to study teachers' planning, thinking, behaviors, and conceptions (di Gregorio & Davidson, 2008). In addition, "documentary data are particularly good sources for qualitative case studies because they can ground an investigation in the context of the problem being investigated" (Merriam, 1991, p. 112). The format of the CIR forms in Spring 2012 was slightly different from that in Fall 2011 due to the different requirements on how the assignment should be completed. The format of the CIR forms in Fall 2011 was more structured with more scaffolding to help participants complete the assignment, such as with a sample CIR form (*see* Appendix F). While in Spring 2012, in addition to being less structured, the assignment incorporated group collaboration in participants' CIR forms (*see* Appendix G). Interview data were used in this study as a secondary source of data to look into the research questions in depth and for triangulation.

As mentioned above, using documentary data helped me explore the research problem unobtrusively because documentary data collected are nonintrusive as they are usually produced for personal or educational reasons instead of research purpose. They can help the researcher understand an individual's inner experiences and reveal his/her inner world without the interference of research. Personal documents are individuals' first-person written accounts of the whole or parts of their lives or their reflections on a specific event or topic (Merriam, 1991); thus, they are "reliable source of data concerning a person's attitudes, beliefs and view of the world" (Taylor & Bogdan, 1984, p. 113).

In addition, interview data, in which the participants elaborated on their video-aided reflection experiences, were collected for analysis by following an interview protocol (*see* Appendix H).

The CIR forms and the videos of their teaching were submitted for grading as normal parts of participants' coursework in the program while only the CIR forms were selected as research data for this study. Five of the participants were selected for an interview. Thus, participants' CIR forms and the interviews were examined as data to answer the research questions. Pseudonyms were used in the data analysis and report to protect the true identity of the participants. The interviews were transcribed and the a summary of the transcript was sent to the participants for member checking to ensure that the interview data and interpretation were accurate. Table 7 summarizes the data collected for this study.

Table 7

Table of Collected Data

Participants (Pseudonyms)	**CIR_ Forms_ Peer_Fall2011**	**CIR_ Forms_ School_Fall2011**	**CIR_ Forms_ School_Spring2012**	**Interviews**
Becky	2	2	1	1
Daisy	2	2	1	1
Elliot	2	2	0	0
Emily	2	2	1	1
Kate	2	2	1	0
Lance	2	2	1	0
Mariah	2	2	1	0
Patricia	2	2	1	0
Sheryl	1	1	1	1
Ted	2	2	0	0
Teresa	2	2	1	1
Sub-total	21	21	9	5
Total CIR Forms			51	5

Near the end of Fall 2011, with the arrangement of the instructor of the Methods class that the participants were enrolled, I went to the class and explained the purpose of the study and the procedure to protect their identity if they decided to participate. I informed participants that their participation was voluntary and that the data would in no way reveal their true identity. After a brief introduction about this study, I distributed a copy of the Informed Consent Form for the coursework (*see* Appendix A) to every student in the class. Fifteen out of the19 students in the class volunteered to participate in this study and signed the consent form to allow me to use their course work as data for this study. The CIR forms and the videos of all the students enrolled in the Methods class were given to me. Only the CIR forms and the videos of the consenting students were copied and returned to the instructor who returned the assignments to the students. This procedure ensured that the instructor was not aware of the identities of the students participating in the research. As required by IRB, the research data was collected after participants' grade had been submitted. Every participant who gave permission for me to use their CIR forms as data got a five-dollar Starbucks gift card as described in the IRB protocol. In addition, I sent each participant an e-mail to express my appreciation for his/her participation.

As per the recommendation of my dissertation committee, a second-round data collection was conducted in Spring 2012 to examine the development of participants' professional knowledge as the result of the video-aided schematization and theorization. Despite the similarities of the two Methods classes that participants took in Fall 2011 and in Spring 2012, an IRB amendment was required because the titles of the two Methods classes were different, meaning that the Method class in Spring 2012 had a different

name than the one that was specified in the original IRB protocol. The amendment of the IRB protocols caused adjustment to most of the documents that had been submitted for the original IRB protocol, including the Informed Consent Form (Coursework), the Recruitment Script, and the Informed Consent Form (Interview) (*see* Appendix A – E).

The instructors of the Methods classes helped me distribute the Informed Consent Form (Coursework) to the former participants, who participated in Fall 2011. Twelve of the former participants were taking a science Methods class, while three were taking a literacy Methods class. Six out of the twelve former participants enrolled in the science Mthods class signed the Informed Consent Form (Coursework) distributed by the instructor of the class. None of the former participants enrolled in the literacy Methods class signed the consent form. In order to recruit more participants, I sent out e-mails to invite those former participants who had not signed the consent form to participate. Fortunately, four more former participants volunteered to participate; thus making the total number of the participants of Spring 2012 to reach ten. I was given access to the LiveText account that the science Methods class was using to collect the CIR forms of the consenting participants although two were excluded from the research.

During Summer 2012, five participants who had given permission for me to use their CIR forms volunteered to take part in an interview with me. The recruitment process did not go smoothly. I sent multiple e-mails to those who had indicated their interest in the interview on the Informed Consent Form (Coursework) (*see* Appendix A) asking for participation and also making adjustment from face-to-face interview to phone interview because the recruited participants preferred to have the phone interview for their convenience. The interviews lasted less than 45 minutes. At the beginning of the

interview, I thanked the participants for their participation and informed them that the interview was being audio-recorded (*see* Appendix H). The recorded interviews were saved as .mp3 files labeled with participants' pseudonym and stored in a computer and in cloud that are both firewall and password protected.

As in Fall 2011, every participant who gave permission for me to use their CIR forms got a five-dollar Starbucks gift card. Those who participated in the interview got a ten-dollar Starbucks gift card. In addition I sent each participant a thank-you note with the gift card to express my appreciation for his/her participation.

Data management includes organizing and storing data in a systematic way for later use and retrieval, either physically or through computer programs, and displaying data visually using charts, tables, matrices, diagrams, etc. (Savenye & Robinson, 2005). For this study, data from different sources were organized into folders for each participant both in print and in digital formats. The research data included participants' CIR forms, and the audio recordings of the interviews. Participants' CIR forms were collected and copied and the originals were returned to them by the instructor in Fall 2011. In Spring 2012, I was allowed access to the course LiveText account to select the digital version of participants' CIR forms that they had submitted as their course work. A key matching participants' name with pseudonyms were generated. The participants' name were removed from any collected data and substituted with a pseudonym to ensure that no identifiable data were used in the dissemination of this study. All collected data, consent forms, and pseudonym key were stored in a locked filing cabinet in a room of the department where the participants are enrolled in the method class. Consent forms and pseudonym code keys were stored in a separate filing cabinet from research data. Two

copies of audio and video recordings were kept; an original master copy and a working copy. All collected data will be kept for an additional two years after the dissemination of the study. All data will then be disposed of or destroyed securely.

In addition to the physical management of collected data, data were also organized using QSR's NVivo 10, a computer program for qualitative data organization and analysis, and stored in a computer that is both firewall and password protected. To facilitate data organization and data analysis, I used qualitative data analysis software, NVivo 10, developed by Qualitative Solutions and Research (QSR) International. The reason for using NVivo 10 to analyze the data was because it supports qualitative data analysis through managing data, managing ideas, querying data, graphically modeling, and reporting from the data (Bazeley, 2007). I first imported all the collected data into NVivo10 as internal sources for later analysis, including the CIR forms and the transcription of the interviews. The data was organized into 2 folders according to the data source: CIR forms and interviews. The CIR forms folder consisted of two sub-folders: CIR_Forms_Fall2011 and CIR_Forms_Spring2012. Each of the 2 sub-folders contained next-level sub-folders labeled with participants' pseudonym. The Interview folder consisted of sub-folders that were labeled with participants' pseudonym as well.

Data Analysis

"Data analysis is the process of making sense out of one's data….In the process of analysis, data are consolidated, reduced, and to some extent, interpreted" (Yerrick, et al., 2005, p. 357). In the field of education, researchers interested in inferring psychological variables of the authors from the texts and artifacts they produced use content analysis as a research method to analyze text in the form of personal documents,

diaries, recorded speeches, and videos. Content analysis by itself is a research method that generates inferences from all kinds of verbal, pictorial, symbolic, and communication data. As a research technique, content analysis provides specialized procedure for researchers to make replicable and valid inferences from texts (or other meaningful matter) to the context of their use. This technique aims to provide new insights, increase understanding of particular phenomena, or inform practical actions (Merriam, 1991).

Content analysis can be quantitative or qualitative. Qualitative content analysis has the characteristic of being *interpretive.* It requires reading data closely as well as interpreting data in new analytical or critical narratives with the expected reliability and validity that are accepted by members of particular scholarly communities. Reliability in content analysis means that the result generated should be the same despite the difference of time and circumstances, and validity means that "the resulting claims can be upheld in the face of independently available evidence" (Krippendorf, 2004, p. xxii). The first step in qualitative content analysis is to unitize the data or identify units of information to be used as the basis for defining categories. A unit is the smallest piece of information about something interpretable by itself. The units of information will then be coded according to categories representing situational factors or emerging themes or concept. A code is a symbol applied to a segment of words to classify the words (Krippendorf, 2004, p. 19). Situational categories are factors about who, what, when and where. Conceptual categories are higher level and integrating conceptualizations developed during process of coding and analysis of data. Categories are developed by looking for recurring regularities in the data, determining what fits together, and fleshing out the categories once they have been developed. In other words, category development is finding patterns

or themes and compiling the conceptual categories. The categories should be internally homogeneous and externally heterogeneous. Homogeneity means that all items in the same category share similar characteristics. Heterogeneity means that the differences of categories should be clear (Miles & Huberman, 1984).

The approaches used in the data analysis of this study involved two steps. First, I familiarized myself with the collected data. Before starting to code the data, I read the CIR forms several times to get intimate with the data. While reading the printed CIR forms, I started the initial analysis using a pencil to jot down on the right margins the initial codes. After I finished the initial coding, I read them through and developed the categories or patterns based on the guidebook (*see* Appendix J - K). I then labeled the initial codes on the left margin the categories that they belonged to.

In order to generate an initial coding scheme, I needed to use one participant to start with; therefore, I chose Becky because her data was very rich and complete, consisting of the five CIR forms: four from Fall 2011 and one from Spring 2012, and the interview data as well. The next step in data analysis was to code the data in NVivo 10 into free nodes. Free nodes were simply storage points for ideas emergent from data, or codes. At this point, the ideas labeled as codes did not presume any relationships or connections with other ideas, which were similar to the codes I labeled on the right margin of the printed data. Free nodes were later moved into tree nodes, which served as the connecting points for subcategories of types of concepts, similar to the categories I labeled on the left margin of the printed data. Relationship nodes, which recorded a particular kind of connection or association between two project items, such as cases,

categories or concepts, documents, memos, were then developed based on the characteristic shared. The characteristics could be shared by similarities or differences.

Tree nodes help 1) organize the data and create order out of chaos, 2) give meaning to concepts and clarify ideas, 3) ensure the completeness and thoroughness of coding, and 4) identify patterns and associations between groups of codes. Relationship nodes record a particular kind of connection or association between two project items, such as cases, categories or concepts, documents, memos, etc. (Bazeley, 2007).

After coding Becky's case, I compared the themes derived from the data with the literature in order to regulate the terms I used as the themes. I used the InTASC core standards (2011) to guide the coding of the foci of participants' reflection in their CIR forms (*see* Appendix J). InTASC stands for Interstate Teacher Assessment and Support and the InTASC core standards were developed by the Council of Chief School Officers (CCSSO). The core standards consist of ten standards in divided into four categories:

1. The Learner and Learning: Standard #1 - 3: learner development, learner differences, and learning environment
2. Content Knowledge: Standard #4 - 5: content knowledge, and application of content
3. Instructional Practice: Standard #6 - 8: assessment, planning for instruction, and instructional strategies
4. Professional Responsibility: Standard #9 - 10: professional learning and ethical practice, and leadership and collaboration

I used the definitions of the different categories of schema change to guide the coding of participants' VAST, informed by the relevant literature described in Chapter 2

(see Appendix K). Therefore, the InTASC core standards and the terms of different kinds of schema change were used as the priori-coding scheme for data analysis. When dealing with *a priori* coding, the categories are established prior to the analysis based upon some theory. Professional colleagues agree on the categories, and the coding is applied to the data. Revisions are made as necessary, and the categories are tightened up to the point that maximizes mutual exclusivity and exhaustiveness (Weber, 1990).

Another rater was involved in coding around thirty percent of the total of the CIR forms, which was composed of four participants' CIR forms: Becky, Lance, Sheryl, and Ted. Three of them are Caucasians: Becky, Lance, Ted, and one is African American: Sheryl. I tried to include both genders and different ethnic groups in the selection of the cases for inter-raters to analyze. The rater was familiar with content analysis and has just graduated from a well-known educational institution in May of 2012 with a doctoral degree. Additionally, the rater had 15 years of teaching experience at both middle-secondary education and higher education.

The training process of the inter-rater involved familiarizing him with the theoretical and methodology framework, terms, and the coding process. The 17 CIR forms collected from the 4 selected participants were first coded separately by each of the raters on the coding form guided by the coding guidebook. Then the results were compared and discussed. The inter-rater reliability was calculated, using the percent agreement: ReCal2 – Reliability Calculator for 2 coders and the agreement percentage reached 90% after negotiated agreement.

Trustworthiness

Whether a qualitative study is trustworthy or not is determined by its internal validity, reliability, external validity, and ethical issues. Internal validity asks such questions as "Are we measuring what we think we are measuring?" or "How congruent are the research finding to reality?" Reliability refers to the extent to which research findings can be replicated. External validity, also known as generalizability, refers to the extent to which findings of a study can be applied to other situations (Merriam, 2002a). Ethical issues deals with how participants are informed of the research purpose, and how much privacy and protection participants can get in the research.

Triangulation

Multiple sources of data and data collection methods over an extended period were used in this study, including CIR forms collected in Fall 2011 and Spring 2012, and interview data collected in Summer 2012, which helped ensure the reliability of this study. Data collected in this study, including both text data and interview data, were considered reliable sources of data. Text data are considered more reliable than interviews even before they are manipulated by the researchers.

The only issues of reliability in text data analysis lie in the categories that are used to analyze each text. Hammersley (1992) describes reliability as "the degree of consistency with which instances are assigned to the same category by different observations or by the same observer on different occasions" (p. 67). It is vital that the categories be used in a standardized way in the data analysis so that the data is categorized the same by different researchers, which is known as inter-rater reliability. Inter-rater reliability requires that same data first be analyzed by a number of analysts, or

raters, according to an agreed set of categories; and then the reports from the raters are examined and compared, with any differences discussed and opted out. Two raters were involved in the data analysis to offset the bias that could have caused by a single rater. As mentioned earlier, the other rater has recently obtained his doctoral degree from another research institute, and we had previously worked together on research projects. He has worked in the field of education for many years and he used a quantitative content analysis method for his dissertation, which share similarity with the methodology used in this research in terms of coding scheme and procedure. Therefore, the other rater had the capability to raise questions about potential issues that could affect the credibility and accuracy of the data analysis and interpretation.

In addition, when collecting the interview data, I ensured that each participant understood the interview questions the same way so that the potential uncertainty in coding the answers could be prevented. Other strategies that was used to ensure the reliability of the interview data of this study included audio-recording all the interviews, carefully transcribing these recordings according to the needs of reliable analysis, rather than handing them over to an audio-typist, and presenting long extracts of data in the research report – including the question that provoked any answer (Silverman, 2001).

Member Checks

Member checking was used as a strategy in this study to minimize the bias that might have been caused by not having it. A summary of the interview transcription and tentative interpretations were e-mailed to the interview participants for them to check if they were accurate and plausible. In the e-mail, the researcher informed participants that

they could make changes or delete the interpretations that did not represent what they meant in the interview.

Peer Review

Peer review was also used in this study to minimize the bias that could have arisen without it. A former doctoral fellow who graduated a year ago reviewed the dissertation and made suggestions for changes.

Researcher's Reflexivity

Researcher's reflexivity refers to the critical self-reflection by the researcher regarding assumptions, worldview, biases, theoretical orientation, and relationship to the study that may affect the investigation (Merriam, 2002a). To me, how people develop their professional knowledge is a question that I have been curious about because the best way I learns about something new is through looking back on my experience, or through reflecting on what worked, what did not, and what could have been done differently.

This study was developed in a spiraling instead of a linear manner. I started with a general idea about the research topic – novice teachers' cognitive processes using digital video technology. The rough idea came from my experience both in learning and teaching with digital video technology. With a rough idea, I began to read relevant literature and studies, but found that the focus of most research revolved around the use of digital video technology in teacher education to promote novice teachers' reflections, rather than how novice teachers learn with the technology. Using digital video technology to enhance novice teachers' cognition seemed to be an area that needed more research. With the attempt to fill a notable gap in literature, I determined to look into the

issue, so I began to search for a research design that would help interpret novice teachers' cognitive processes when they were reflecting on their teaching with the help of digital video technology.

Limitations of the Research Methodology

The study has the following limitations. First, the knowledge produced might not be generalizable to other people or settings, meaning that the research findings might only apply to the specific context and participants included in this study. Second, it was difficult to make quantitative predictions and difficult to test hypotheses and theories because testing theory was not the purpose of this qualitative study. Third, the research results were more likely influenced by my personal bias and idiosyncrasies. I, as an important instrument in the data collection and interpretation of the study, might have bias that came from my life experience, educational, and cultural background.

Summary and Overview

This chapter described that a qualitative case study method was employed in this study and explained why I chose it as the research method for this study. This chapter also described in detail the context, participants and sampling, data source, collection and management, data analysis, trustworthiness, and limitations of the research methodology.

The next chapter, Chapter 4: Findings, is a report of the results the data has revealed in terms of the foci of participants' reflection evidenced in their CIR forms, and their VAST when they were reviewing and reflecting on the data. The findings were

organized and presented, in detailed description for each participant, as answers to the research questions. The findings from the interview are presented as a separate section.

CHAPTER 4

FINDINGS

Introduction

The findings of this study were organized and presented for each participant to describe in detail the foci of the participants' reflection when they were reviewing the video of their teaching, how they connected their video-aided reflection to their prior knowledge and future action, or how their video aided schematization and theorization (VAST) work. Participants' schema will be compared between Fall 2011 and Spring 2012 and summarized in a table. In addition, in the summary for each participant, I will discuss participants' levels of knowledge, phases or levels of learning (*see* Table 3), the stages of their development (*see* Table 5), and schema change as demonstrated in their CIR forms.

The foci of the participants' reflection are themes that were generated from the coding of participants' CIR forms and measured according to the InTASC core standards (*see* Appendix J). Participants' schema change and development were measured by schema accretion, tuning, and restructuring (*see* Appendix K). The foci of participants' reflection were either from their own description or from my interpretation and inference from their CIR forms that they completed as course assignments in Fall 2011 and Spring 2012, and the interview data if he/she participated. I selected the first incident of the participants' CIR form from their practicum teaching to represent, with an illustration, what the participants focused on in their reflection and how they made connections between their prior knowledge and their future action, or how their VAST worked. The illustration sketches the schemata of the participants involved in their

reflection. In the illustration, the oval callout in the center represents the identified critical incident described in the CIR form, which serves as a visual prompt that triggered the participants' thought about the elements that were affected in teaching and learning. The affected elements are demonstrated in the rectangle shapes, with some of them connected with an arrow in between to show the causal relationship or without an arrow to show a mutual relationship. The hexagons represent the affected schemata, and the diamond represents the theory that consists of a network of connected schemata, which is composed of various elements. For the rest of the incidents, I explained in the same details as in the participants' first incident of their practicum teaching, but without an illustration.

Becky

Introduction

Becky is a young White female between the age of 18 and 22. She had no previous teaching experience. The subject she was teaching was math, specifically distributive property. The data collected from her included five CIR forms: four from Fall 2011 and one from Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching and two from the video of her peer teaching in Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below. In addition, Becky also participated in the interview.

Becky's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 20 to 22 minutes into the video. In her video-aided reflection, Becky focused on planning for instruction, instructional strategies, learner development, learning difference and learning environment.

CIR Form # 2: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 24 to 26 minutes into the video. In her video-aided reflection, Becky focused on planning for instruction, instructional strategies, communications, learner development, and learning environment.

CIR Form # 3: This incident described in her CIR form of the peer teaching in Fall 2011occurred between eight to 12 minutes into the video. In her video-aided reflection, Becky focused on planning for instruction, instructional strategies, especially communications, assessment, learner development, and learning environment.

CIR Form # 4: This incident described in her CIR form of the peer teaching in Fall 2011occurred also between one to three minutes into the video. In her video-aided reflection, Becky focused on planning for instruction, instructional strategies including communications of teacher expectations and questioning strategies, and assessment.

CIR Form # 5: This incident described in her CIR form of the practicum teaching in Spring 2012 occurred around six minutes into the video. In her video-aided reflection, Becky focused on instructional strategies including classroom management, teacher-student interaction, student-student interaction, student engagement, and learning environment.

Becky's VAST

CIR Form # 1. The video described in her CIR form #1 helped Becky notice her action in the classroom that she could not have recalled without it. Just as she wrote: "This [her pacing rapidly around the classroom] can easily be seen in the tape by watching it or fast forwarding it". In her video-aided reflection, Becky pointed out that she was confident about what she had planned until she saw her action in the video. "After giving the students their assignment and giving them a second set of instruction…I felt confident about the situation". However, when some students finished their assignment earlier than she had expected, Becky got nervous and began to pace rapidly back and forth in the classroom because she was not prepared for the situation and did not have a lesson plan and instructional strategies to keep those students engaged.

> This [her pacing back and forth in the class] starts happening after students started to finish their assignment a lot sooner than their peers. There was not another assignment planned for them to do, so homework was distributed to some students that did not have anything else to do.

In her video-aided CIR form, Becky described in detail how what she saw in the video challenged her prior knowledge or schemata of instructional planning and instructional strategies. Her schema about her planning for instruction, which she was confident of, was challenged by the visual stimulus of what she saw in the video. Therefore, her schema had to change or tune to accommodate to the new information that her instructional planning was not able to engage all student. Her schema also changed by accretion because she realized that she needed an alternative lesson plan that could support the learning of all students. Her schema changed by schema tuning and schema accretion. Schema tuning occurred when her existing schema about her planning for instruction had to be adjusted because it was insufficient to meet the needs of all students.

Schema accretion occurred when she added into her existing schema of instructional planning and strategies the new information that alternative instructional plan and strategies were needed to support the learning of all students.

The analysis of Becky's CIR form revealed that she made connections between the various elements of her planning for instruction and instructional strategies and learner development, learning difference, and learning environment, with specific aspects (*see* Figure 5). Becky's pacing back and forth rapidly around the classroom was a sign of her nervousness and unpreparedness, which was caused by her lack of an alternative lesson plan and instructional strategies to handle that kind of situation. Additionally, her action also caused students' confusion about what they were supposed to do with the

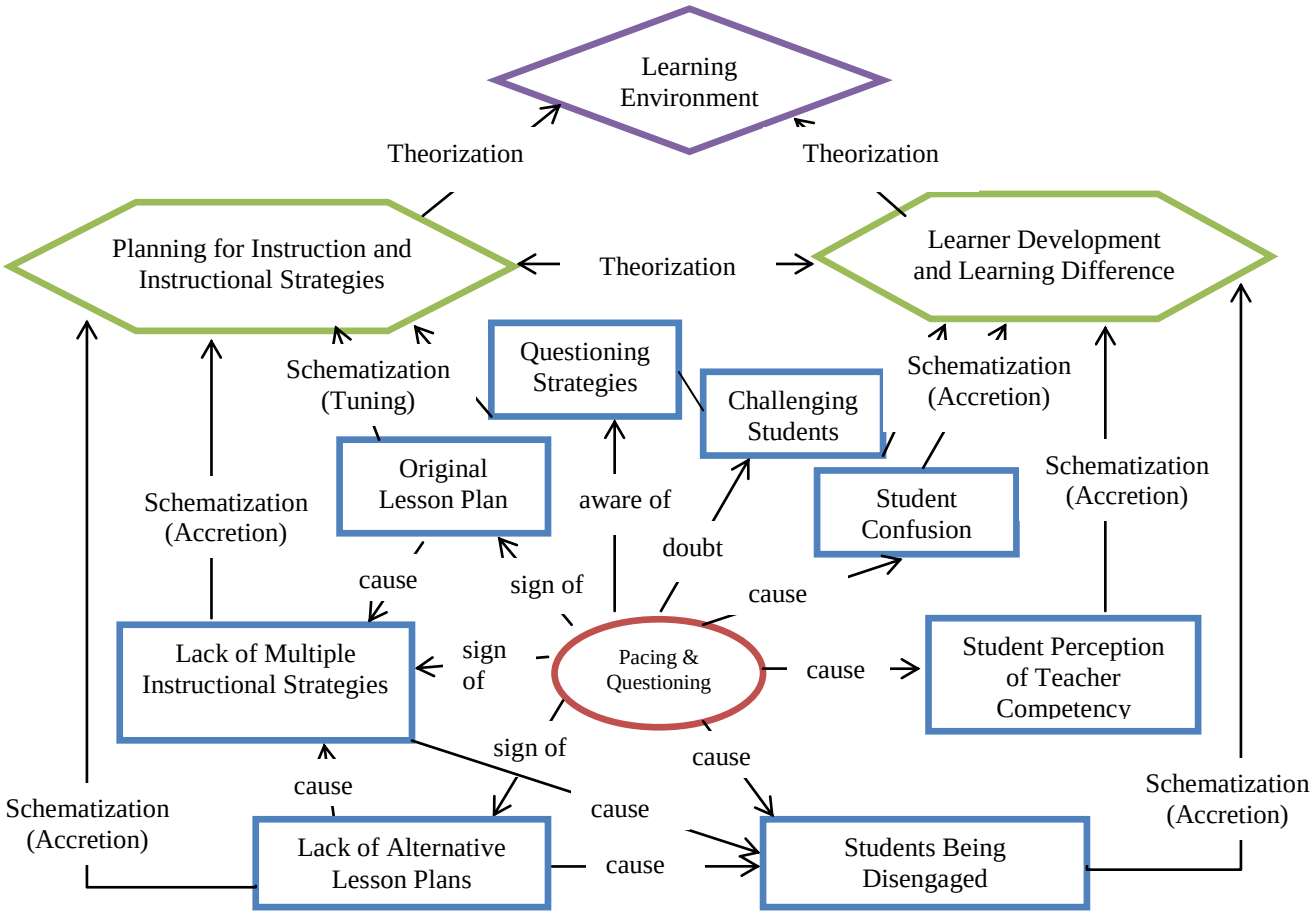

Figure 5. Becky's Foci of Reflection and VAST Evidenced in the Example CIR

lesson or whether they had done something wrong. Becky was also aware of how students perceived her action and assumed that students could question her competency as a teacher when they saw her moving quickly around the room: “Maybe we were running out of time for the class and she wanted to fit everything in. Whatever it was, she wasn’t comfortable with the lesson”.

In addition, without an alternative lesson plan, she was not able to challenge and support the learning of those students who had finished the assignment earlier than others and had nothing to do.

> After students started to finish their worksheet a lot quicker than I thought they would, I was at a state where I didn’t know what to do. Half of the class was still finishing and some struggling on the worksheet and other half was doing nothing because they were done….I did not prepare anything for students that understood the terms and steps the first time around so they were not engaged after they finished their activity.

Moreover, Becky’s reflection about her action in the video affected her future lesson planning and helped her make quicker action in her future teaching.

> Because I became nervous and wasn’t prepared for some students finishing early and some taking more time than allotted I don’t think I was supporting the learning of all students to the best of my ability. I should have had something else planned just in case students finished early and understood the assignment. Although I think I saw that there was a problem while I was monitoring their progress, I think I should have seen this earlier in order to plan accordingly with different assignments or strategies.

There was another visual stimulus in the video that challenged Becky’s schemata of instructional strategies and student learning. Becky valued challenging students’ learning, but from the video she realized that the questions she asked were mostly “yes” and “no” questions.

> Going into the lesson I thought I valued challenging students. But after looking at the tape I noticed I mostly asked yes or no questions and did not inquire about

> other things that the distributive property could apply to…. This is something as an educator that I need to fix and plan better for next time.

Becky's questioning strategy in the video made her challenge her prior knowledge about what questions to ask to stimulate students' high-level thinking. She realized that those yes-no questions were not able to challenge students and that challenging students involved asking challenging questions. In her future action, Becky planned to incorporate appropriate questioning strategies to cultivate student learning. The schema change involved schema tuning, that is, she needed to ask more challenging questions instead of the yes-no questions if she wanted to challenge student learning.

Just as Becky summarized, the video-aided reflection was able to help her realize what she needed to improve (RoA) in her teaching and what she needed to do (RfA) in her future teaching, such as providing a challenging yet supportive lesson plan and creating a learning environment that will enhance student learning.

> In light of reviewing the tape that I took during my lesson plan…I will plan better next time…I forgot that some students may grasp the concept very quickly and be able to have time to do something more challenging. I will be more prepared with different types of activities that I could do within the class period in case something goes differently during the instruction time and also more challenging work for students that seem to be moving quicker than other students on a particular activity or assignment. I will also try not to wear my emotions on my sleeve. It is important that students feel comfortable in my classroom and if I'm depicting a nervous persona in the class then the students will become nervous or will not take me seriously because they will catch on to my cues.

CIR Form # 2. In this incident, Becky asked students to write letters to soldiers with the purpose of helping them understand the subject: distributive properties. She explained to the students very briefly how the activity was related to the distributive property and put them into partners to work together. She did not give any example or notes about distributive property, an important part of the assignment that she did not explaining clearly.

> I wanted the students to tell the soldier they were writing to how they could solve an equation using the distributive property or how they remembered the distributive property. I did not have a letter for an example nor did I make putting a little note about the distributive property in the letter an important part of the assignment when I was explaining it.

The video described in her CIR form helped Becky notice that students' disengagement and confusion was caused by her lack of communication about the connection between the activity and the subject matter. She did not explain the reason why students were asked to do the assignment, thus causing students to be unable to connect what they were doing with what they were learning. She also realized that she overestimated the students' ability and thought they were capable of making the connection between the subject and real life events despite her intention to make "the distributive property into real life or make it meaningful for a student to remember. I don't think the students really connected with why they were doing the letters at all. It seemed kind of random to do it in this lesson".

In her video-aided CIR form, Becky described in detail how what she saw in the video challenged her prior knowledge about her instructional strategies, application of content, particularly choice of curriculum materials, and learner development. Her schemata changed by tuning and accretion. Schema tuning occurred because she had to adjust her existing schema of learner development by incorporating the new information that she overestimated students' ability to make connections between the activity of writing letters to soldiers and what they were learning: distributive property.

> I believe that students do not know what to do unless they are asked or explained how to do so. I as an educator cannot expect a student to read my mind and know what they should be doing or not doing. I need to voice to my students what I need and what I expect from them each day and on each assignment. Students are not going to be successful by doing assignments and activities the way they think they should be done. Students will achieve success if they are shown what to do

> and are able to see connections and rationales for doing assignments, activities, and projects.

Schema accretion occurred because she added to her existing schema of instructional strategies the new information that she needed to provide a clear explanation about the purpose for what the students were doing.

> I was not able to communicate high expectations for all students for this assignment. Because I did not explain this assignment well nor held it to high regard when mentioning it, my attitude was conveyed to the students and they did not take the assignment seriously. Through this, I also had to lower my expectations because students did not understand what they needed to do because it was not clear to them.

The analysis of Becky's CIR form indicated that she made connections between the various elements of teaching and learning, such as instructional planning and instructional strategies, clear instruction and communication, student development and student learning. When Becky saw students' being off task, she realized that she did not articulate clear rationales for the choice of the curriculum materials and instructional strategies. Therefore, students could not connect the learning activity with what they were learning. What caused the unsuccessful communication was her overestimation of students' understanding.

Becky's video-aided reflection on her teaching practice (RoA) triggered her schema change, which in turn affected her future decision-making and action in teaching (RfA). Just as Becky summarized,

> I will make directions clear. I will tell the students exactly what is needed of them and why they are doing the assignment. Students need to know how assignments link with what they are learning in the classroom. They also need to know how concepts are linked to the outside world. Sometimes this relationship is not obvious to students so it is the instructor's job to explain this to the students. If this is not done, students will become confused and will not reach full mastery of the concept being taught. As an educator I will make sure that my students are

> aware of what the outside world is like and how math and science are related to our lives outside of the classroom.

The video-aided reflection helped Becky realize what needed to improve in her teaching (RoA) and what she needed to do in her future teaching (RfA), such as providing a challenging yet supportive lesson plan and creating a learning environment that will enhance student learning.

> In light of reviewing the tape that I took during my lesson plan…I will plan better next time…I forgot that some students may grasp the concept very quickly and be able to have time to do something more challenging. I will be more prepared with different types of activities that I could do within the class period in case something goes differently during the instruction time and also more challenging work for students that seem to be moving quicker than other students on a particular activity or assignment. I will also try not to wear my emotions on my sleeve. It is important that students feel comfortable in my classroom and if I'm depicting a nervous persona in the class then the students will become nervous or will not take me seriously because they will catch on to my cues.

CIR Form # 3. In this incident, Becky asked students to make predictions based on what they had known about the relationship between the Earth, Sun, and Moon. Each group was instructed to make a model based on the prediction that they came up with. They were to draw their model on the board to show the class and explain what was going on in their model. During this time, she went group by group to get their feedback and help them explain what they drew. She didn't ask any higher-level questions during this period in the lesson.

Becky realized when reviewing the video that she was not asking students questions to assess their prior knowledge before she asked students to draw the prediction model; thus, not making this activity tied to the rest of the lesson.

> Because I was not asking questions and assessing to see where the student's knowledge was, I did not know where to start with the lesson. I was unsure as to where I should start or the level of instruction I should have done because I was not asking higher level questions. This made me question why I was having the

> students make these models in the first place because I was not linking this activity with the rest of the lesson.

The video helped Becky make connections between not assessing students' prior knowledge and other elements that could affect student learning, such as planning, instructional strategies, and learning environment, She valued helping students make connections between what they had learned and what they were going to learn although she did not explain to the students why they were asked to do the prediction and the model activity.

> I believe that teaching students by inquiry is very meaningful and special to students. When students are given the chance to make predictions about what they are going to be learning about and go from there, they are more prone to remember the activity and enjoy the material being taught because they want to know if they were correct or not. I also believe that connecting their predictions with what is actually true is important too.

She also realized that the role of the teacher in helping students make the connections as well as the specifics the teacher needed to do to achieve it.

> Sometimes students are not able to make connections from their own work to what is real. The teacher is there to make those connections for them and to correct their previous thoughts and explain why it may be wrong. If this is not present students may become confused and may not want to participate in the rest of the lesson.

Although Becky believed the importance of assessing students' prior knowledge, she had not planned well to ensure that it happened. Becky's video-aided reflection (RoA) helped her realize what she needed to improve in her teaching and how to make the improvement in her future teaching (RfA).

> I will make sure that my students are making connections with their thoughts to the outside world... I will work on my guided instruction and the questioning that I use when doing an inquiry type lesson. Students need to be asked the right questions in the right way in order to find knowledge that they need in order to master concepts. Without this type of questioning students can become confused

> and may block themselves from doing an inquiry type lesson again because they do not want to confuse themselves.

Becky experienced schema accretion because she expanded her existing schema: adding the specifics of assessing students' understanding by asking questions and plan instructions that link each part of teaching to create a supportive learning environment.

CIR Form # 4. In this incident, Becky led students in a quick review of what they had learned in the class. She did not want to use higher-level terms in the review because students did not have a chance to use them in the earlier sessions of the class.

> Because I had not used a lot of higher level terms with the students I didn't think that it was fair to bring them up during the review at the end of the class. I knew that the students had learned a lot during this lesson informally and that a lot needed to be reviewed and talked about.

When reviewing the video, Becky realized that she could have taken the time to go over what students had learned and call on students who needed help instead of going to the next question as soon as she heard one student blurt out a right answer. She could have used the time to help students make connections among the concepts they had learned in class so that they would not forget them easily. She could have used the review session to challenge students by asking higher-level question and communicated high expectations, and showing them that she valued their mastery of the knowledge that they had learned.

> I was not able to communicate to my students that mastery of the knowledge that was taught was important. Because I did not take the review seriously and ask higher level questions, I did not promote a challenging classroom nor did I communicate high expectations for all students. I only asked very simple questions that were just answered about 10 minutes ago, so students were able to answer them very quick without thinking and analyzing the question being asked.

Becky also elaborated on her belief about education and the reason why it was important to challenge students and encourage students to challenge themselves.

> I believe that all students should be challenged. Because I did not challenge my students to think more into what was taught during the class, I did not encourage them to challenge themselves. Students need to think critically and more in depth about what they are being taught. Education is about learning more than what is expected of them, not just doing the bare minimum. As an educator I believe that review and higher level questioning is a must in a classroom and I did not show this in my lesson.

As can be seen from what has been described above, Becky made connections between various elements of teaching and learning, such as assessment of students' understanding and knowledge, learner development, communication of high expectations, and instructional planning and strategies. Becky's video-aided reflection on her teaching experience (RoA) led to a specific plan that she could use in her future teaching (RfA)

> I will challenge my students by asking them higher level questions and encouraging them to think critically about what they are learning. I will use my time effectively as an educator and not waste time when I could be furthering my students' knowledge and mastery of a concept. I will show my students that I value review time and that they need to show me that they know the material by applying it outside of the classroom, not just spitting back terms and answering simple questions.

Becky experienced schema accretion while she was reflecting on the video of her teaching. She added to her existing schema the new information of a well-planned reviewing session to her existing schema of instructional planning and instructional strategies.

CIR Form # 5. In this incident, Becky asked students to complete the "Do Now" task. She found when she was reviewing the video that "a lot of students were off task and they were not addressed and asked to focus". Becky liked to use video in her reflection because it could help see things she was not able to see without it.

> The reason I used this video is because a lot of students were off task and they were not addressed and asked to focus. From looking at the view that the camera

> had, there were many students at the back of the classroom that were not paying attention to me going over the problems. I even got irritated and asked if I needed to even go over the problems in the first place. The classroom was very disconnected and not focused on the assignment at hand.

Some students wanted to hear whether their answers were correct when she was reviewing, but they couldn't because the classroom was too noisy. Becky was trying to take control of the class, but it did not work.

> Some girls were paying attention and were trying to see if their answers were correct but so many other students weren't engaged in going over the questions so I'm sure it was really hard to focus or hear.

She also noticed that she tended to call on just one student and leave the rest of the class unattended.

> Another thing that I noticed in this video is I have the tendency to address only the person I am calling on. I don't look to see if any other students are listening or paying attention while a student is talking. I think that if I was a little more attentive or had a little bit more presence in the room, this would not be an issue.

Becky's reflection on her teaching (RoA) helped her realize that she needed to control the class by her presence and by communicating her expectations to students. She also needed to be more attentive to the whole class instead of just one student and make the activity more interesting to engage students (RfA).

> I will work on making sure that students are paying attention and focusing on the lesson and also making sure that the assignment or activity is engaging and relevant for the students. The "Do Now" questions are something that the school requires in every classroom to get the period started, but I can do more with it and make it exciting for the students instead of doing review problems every day. I think that this would help the students start the period off on the right foot and already be interested in the lesson by the time they may be done with a short activity.

Through watching the video, Becky made connections among various elements of teaching and learning, such as student engagement, classroom management, instructional strategies, and learning environment. Becky experienced schema accretion because she

expanded her existing schema of instructional strategies by adding new information of having specific rules to manage the class and engaging the whole class while addressing the questions raised by students.

Becky also mentioned that she got valuable feedback from the members of her group and she also "enjoyed giving my peers my feedback on what I think could be better or what they did really well on". However, she mentioned that her peers were not able to give suggestions on what specific she needed to do to handle the situation she encountered in the video.

> The feedback that I received was very valuable to me because I felt that both of my group members really struggled to tell me what exactly I needed to do in order to change the behavior. It seemed very easily to identify the lack of control in the classroom but it was not too easy to state what should be done in order to fix it.

One of her peers recommended that she have more regulations and rules, such as a rule like "there should not be any talking when the teacher is talking … this would really cut back on the behavior issues that I am having". Becky would also like to see peer reflection implemented in school to help teacher with their professional development.

> I would love to implement this in the school that I eventually teach at because I would like to see what my co-workers, or even my current mentor teacher thinks about a problem that I may have in my classroom.

Despite the benefits of peer reflection, Becky also pointed out the potential issues it might cause.

> I don't think that this assignment would be beneficial for individuals that don't reflect on the feedback that they receive and try to change some things in order to reach an ideal classroom. In addition, if the person receives feedback that is not well thought of or is not positive criticism then the person may not be able to grow from the experience.

The connections that Becky made in the CIR form in Spring 2012 were not richer than in those CIR forms in Fall 2011, meaning that there was not obvious development in

Becky's schemata and schematization evidenced in her video-aided reflection. I inferred that it might be caused because of the different scaffoldings Becky had in her video reflection assignment. In Fall 2011 Becky used a sample CIR form that the instructor recommended, which might have provided more structured scaffolding for Becky's reflection and helped her make more connections among various elements of teaching and learning in her CIR forms. While in Spring 2012, Becky's Critical Friends Group members observed her teaching in the video, discussed the critical incident she identified in the video, which could also affected her reflection. One of the focuses of the Critical Friends process is to encourage reflective practice.

The focuses of the Critical Friends process are developing collegial relationships, encouraging reflective practice, and rethinking leadership. The three occasions that uses the Critical Friends protocol are peer observations, tuning a teaching artifact, and consulting about an issue. Each of the three occasions involves the basic elements of reflection through careful description, thoughtful listening, and questioning feedback that consists of supportive and appreciative statements and different ways to think about the issue to challenge thinking and raise concerns (Bambino, 2002).

Table 8

Becky's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4) -Schema tuning (CIR forms: 1, 2)	-Schema accretion (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

What could be a development in Becky's schemata is that she realized that not only her teaching could affect student learning, but also students' interaction and behavior could affect each other in their learning. In other words, Becky's schema of learning environment evolved to include more elements: the interactions between both the teacher and students and among students as well. Table 8 summarizes Becky's schema development and VAST evidenced in her CIR forms in Fall 2011 and Spring 2012.

Summary

To sum up, Becky focused on various elements that were related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions, instructional strategies, assessment, learner development, learning differences, and learning development. The instructional strategies included different elements, such as classroom management and communications that were involved in creating a learning environment that encouraged positive interaction, active engagement in learning. Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to be improved in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed, restructured, and reconstructed her knowledge through schema accretion and tuning.

The level of knowledge Becky demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were contextualized, with some organized. The phases/levels of learning she

showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 5, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Becky was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Daisy

Introduction

Daisy is a White female between the age of 51 and 60. She had no previous teaching experience other than some substitute teaching experience. She was teaching 7th grade math and science. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching, two from the video of her peer teaching in Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below. In addition, Daisy also participated in the interview.

Daisy's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between three to seven minutes into the video. In her video-aided reflection, Daisy focused on planning for instructions, instructional strategies, including

communication, time management, supportive interaction, learner development, learning differences, and learning environment, including student engagement, inquiry, student input and thoughts, and meaningful learning.

CIR Form # 2: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred around two minutes into the video. In her video-aided reflection, Daisy focused on learner development, learning differences and learning environment, including engagement, meaningful learning.

CIR Form # 3: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between 15 to 18 minutes into the video. In her video-aided reflection, Daisy focused on assessment, learner development, learning differences, and learning environment to support meaningful learning.

CIR Form # 4: This incident described in her CIR form of the peer teaching Fall 2011 occurred between 22 to 24 minutes into the video. In her video-aided reflection, Daisy focused on planning for instruction, instructional strategies, including, communication, learner development, learning differences, and learning environment.

CIR Form # 5: This incident described in her CIR form of the practicum teaching in Spring 2012 had no time frame provided. In her video-aided reflection, Daisy focused on planning for instruction, instructional strategies, such as time management and student input and engagement, assessment, and learner development.

Daisy's VAST

CIR Form # 1. In this video Daisy was teaching a lesson on clouds to a 4th grade class. She was using guided facilitation in a demonstration of the four types of clouds.

She noticed, with the help of the video, that she did not have time to answer a student's question.

> I realized that I was running low on time. A student in the front raised his hand, and I told him to wait a minute. Basically, I did not have time to answer him and stated that we need to move on. The student appeared to disengage from the discussion…. I proceeded with my lesson without recognizing if he understood. He could have decided to just disengage completely.

Daisy's reflection on her teaching (RoA) made her aware of what to improve in her teaching, and how to make the improvement (RfA). She wrote that she should have answered the student's question because he could have been confused. She, however, moved ahead because she was short on time.

> I did not meet my student's needs of inquiry. Also, I made it appear as if I did not care or what he had to say was not important. For this reason, the student disengaged. As a teacher, I failed this student. He may not want to ask questions the next time…. I did not utilize effective verbal communication for supportive interaction among my student and I.

She needed to be more responsive to her students' questions and better at time management. Moreover, she elaborated on how she needed do to improve her teaching: "I consciously need to be attentive and monitor such actions. I will self-reflect on my future lessons and become more effective in time management and recognizing my students ' needs".

Daisy experienced schema accretion in her video-aided reflection. She added to her existing schema of instructional strategies the new information of addressing students' questions to engage and support them in learning in spite of time constraints in the classroom.

> I will specifically recognize students who raise their hands and give them a voice in my classroom. Students want to be heard. I cannot push them aside due to time restraints. If I must have them to hold that question, it is vital that I return my

attention back to them. So, they realize that what they have to say is important to me, and I value their input and questions.

As can be seen from what has been described above, Daisy was able to make connection between the various elements of teaching and learning, such as planning for instructions, instructional strategies, including communication, time management, supportive interaction, learner development, learning differences, and learning environment, including student engagement, inquiry, student input and thoughts, and meaningful learning (*see* Figure 6). Daisy experienced schema accretion when reflecting on the video of her teaching. She added to her existing schemata of instructional strategies and learner development and learning differences the new information that

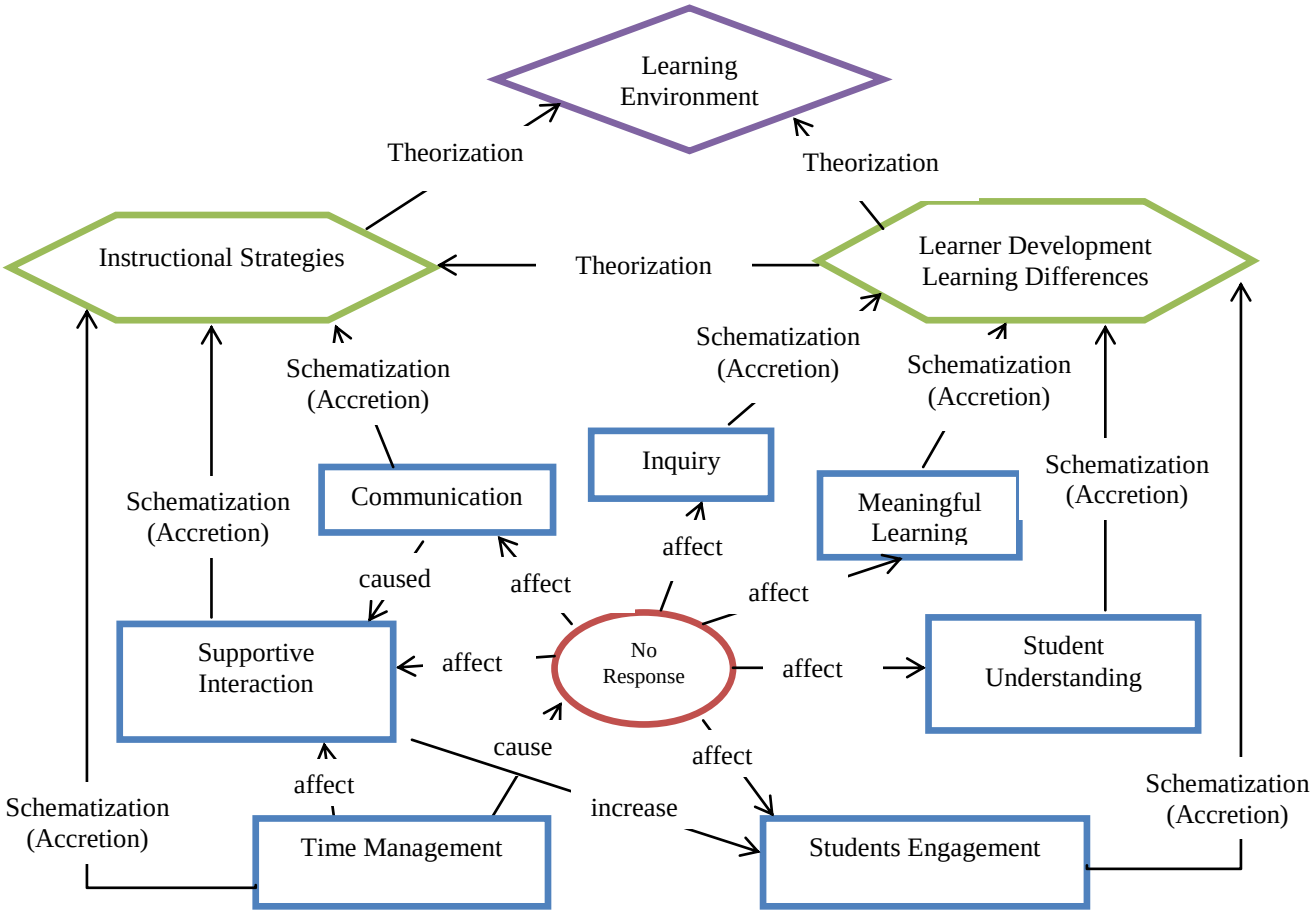

Figure 6. Daisy's Foci of Reflection and VAST Evidenced in the Example CIR

some students might have confusion about what they were learning and she needed to address each student's and not leave any student with confusion about what he or she was learning in order to create a supportive learning environment that meet the needs of all students and support their learning.

CIR Form # 2. In this incident Daisy was teaching 6th grade Cumulonimbus clouds and bad weather and how they were associated. A student asked whether hurricanes occur from those clouds, with a look of wonder on his face. As students would not learn that topic until they would be in higher grade, Daisy did not want to confuse him. She chose not to go ahead with this inquiry. She was also instructed by her mentor not to go beyond the lesson.

> The student's face ignited such a desire to engage him within his inquiry that I could not just move on. I wrestled with myself for a split second after I told him that the class would learn this knowledge later.

Daisy restated her belief and theory she had learned from the program and how she had been taught that students learn best with scientific inquiry and student development.

> I know how students learn and develop knowledge; yet, I did not support the intellectual development of this student and probably the entire class. I should have recognized the cognitive development occurring as the student was in a state of trying to assimilate a new schema and was experiencing disequilibrium. The student is questioning this new knowledge.

Her video-aided reflection on what she did in her teaching and what needed to improve (RoA) helped her realize how to improve teaching in the future (RfA).

> This student could have been in Hurricane Katrina and was concerned. Therefore, I did not fully connect with students' culture concerning weather events which they may have experienced in other countries….I will never hesitate to an inquiry question. I became hesitant and will not falter again. I recognize the golden opportunity which all the students in that class had to learn. They were connecting

> to prior knowledge, and I did not follow through with the student to accommodate and reach equilibrium.… In the future, I shall immediately recognize the intellectual development occurring and continue instead of hesitating.

When reviewing the videos of her teaching, Daisy was able to make connections between satisfying a student's inquiry with other elements relevant to teaching and learning, including instructional strategies, learner development, and learning environment that could engage students in meaningful learning. Daisy experienced schema accretion because she added to her existing schema of teaching and learning the new information: acknowledging learner development, encouraging inquiry and learner development.

CIR Form # 3. In this incident Daisy noticed that students looked confused because she forgot to assess students' prior knowledge.

> I did not effectively plan or assess my students' prior knowledge to ensure they had the skills to complete the assignment and advance their meaningful learning. I must plan and recognize this essential element in teaching to ensure my students are not confused which can lead to disengagement and affect their cognitive development.

When reviewing the videos of her teaching, Daisy realized what she did wrong (RoA), and how to make the improvement in her future teaching (RfA).

> I could have asked if any students have lived near any of the oceans to relate to their real life. I could have further enhanced their learning with this student's knowledge by having this student relate their experience of living near an ocean.

She emphasized that she would never forget to assess prior knowledge and proper planning for instruction to ensure that student were not confused and make learning more relevant and meaningful to them.

Daisy's reflection on the video of her teaching helped he make connections between various elements of teaching and learning, such as assessment of learners' prior

knowledge and understanding, learner development, learning environment to engage meaningful learning. Daisy experienced schema accretion in her video-aided reflection because she added the new information of assessing students' prior knowledge and proper planning for instruction into her existing schema of teaching and learning.

CIR Form # 4. In this incident Daisy noticed from the video that students were confused in the prediction of the oceans on the earth. She did not recognize students' puzzlement until she had shown them the website that had the listing of the estimation.

> I did not provide or support their learning experience. When students are telling me that their data is different, I must immediately stop teaching and modify. Also, I did not effectively communicate to my students and dismiss their group's data as all predictions are different. This dismissal was not only disrespectful. It did not foster an appreciative learning environment of my student's group work.

Daisy's reflection on what she needed to improve (RoA) helped her realized what she needed to do in her future teaching (RfA): she needed to effectively communicate with the students and modify her planning for instructions to create a learning environment that encouraged meaningful learning. In addition, she needed to have better communication with students: "I believe in listening to your students because they will let you know what they need to learn."

Daisy's reflection on the video of her teaching helped her make connections between the various elements related to teaching and learning, such a learner development, planning for instruction, instructional strategies, particularly communication, and learning environment. Daisy experienced schema accretion in her video-aided reflection. She expanded her existing schema of teaching and learning by adding the new information of assessing students' prior knowledge, adjusting lesson plans, and having better communication with students to encourage student learning.

CIR Form # 5. In this incident Daisy was teaching 6th graders on cyclones, anticyclones, and storm formation. She noticed from the video that she kept saying "OK" during the entire PowerPoint presentation and forgot to assess students' prior knowledge. She also realized her "OK" was just her assumption that students were OK with their understanding.

When Daisy was reflecting on her teaching experience captured on the video, she realized that she could have reached out to her students and gave them the opportunity to speak and explain their understanding of the content instead of her self-confirmation by saying "OK". She also realized that they were running behind due to her time management. Even though she could have adjusted her lesson, she did not make the decision to do so: "I must demonstrate time management and ensure students recognize that their understanding is important to me. Just getting through the lesson is not my objective. I really realize that decision making during lessons is an ongoing learning experience".

Daisy's reflection on the video of her teaching helped her make connections among various elements related to teaching and learning, such as planning for instruction, instructional strategies including time management and verbal communication, and assessment of students' prior knowledge. Daisy experienced schema tuning and schema accretion. Schema tuning occurred when she realized that saying "OK" did not mean that students were OK with their understanding. Therefore, her schema about communication had to change by not saying "OK" if she was not sure that students were OK with their understanding. Schema accretion occurred when she added to her existing schema the

Table 9

Daisy's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4)	-Schema accretion and tuning (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

new information of time management and adjustment of lesson plans to ensure student understanding.

Daisy considered that the feedback from peers was extremely beneficial. Their feedback, on the one hand, confirmed her choice of media and technology and her communication style, on the other hand directed her to things she needed to improve in her teaching. As she said, "I enjoyed the comments and learned from my peers. Teaching is a collaborative effort. As a future teacher, I can use all assistance from my fellow students and future teachers."

Table 9 summarizes Daisy's schema development and VAST evidenced in Fall 2011 and Spring 2012. It seemed that Daisy's schematization in Spring 2012 became more mature than in Fall 2011 because she experienced both schema tuning and accretion and made more connections between the different elements of teaching and learning.

Summary

To sum up, Daisy focused on various elements that were related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions, instructional

strategies, assessment, learner development, learning differences, and learning development. The instructional strategies included different elements, such as time management and communications, that were involved in creating a learning environment that encourage inquiry, and meaningful learning. Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to be improved in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed, restructured, and reconstructed her knowledge through schema accretion and tuning.

The level of knowledge Daisy demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were contextualized, with some organized. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 6, with some of the information integrated and logically ordered schemata as shown in the shapes hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Daisy was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Elliot

Introduction

Elliot is a White male at the age 61 and above. He had no previous teaching experience. The subject he was teaching was 5th and 8th grade general science. The data collected from him included four CIR forms: two in Fall 2011 and two in Spring 2012. The four CIR forms described four critical incidents: two from the video of his practicum teaching and two from the video of his peer teaching in Fall 2011. These CIR forms are presented in the chronological order below. I contacted Elliot via e-mail asking him to continue his participation in Spring 2012, but he refuse to give me permission to use his CIR form in Spring 2012.

Elliot's Foci of Reflection

CIR Form # 1: This incident described in the CIR form of his practicum teaching in Fall 2011 occurred within the first minute into the video. In his video-aided reflection, Elliot focused on instructional strategies, particularly communication, learner development, learning differences, and professional learning.

CIR Form # 2: This incident described in his CIR form of his practicum teaching in Fall 2011 occurred within the first minute of the video. In his video-aided reflection, Elliot focused on instructional strategies and student engagement.

CIR Form # 3: This incident described in his CIR form of his peer teaching in Fall 2011 occurred around seven minutes into the video. In his video-aided reflection Elliot focused on planning for instruction, instructional strategies, particularly classroom management, and learner.

CIR Form # 4: This incident described in his CIR form of his peer teaching in Fall 2011 occurred about 20 minutes into the video. In his video-aided reflection, Elliot focused on planning for instruction, instructional strategies, including communication and technology, classroom management, learning differences and professional growth.

Elliot's VAST

CIR Form # 1. This incident helped Elliot realize that he was not talking loud enough for every student to hear him while he was teaching an 8th grade class in a large science lab with 32 students.

> I started to talk in a voice that I thought was loud but in reviewing the tape it was not. My mentor teacher said I needed to project my voice more because the group in the back had trouble hearing me. I never realized that I was a soft spoken person, but the tape doesn't lie.

Elliot thought that students at the back could hear him, but apparently they couldn't. The auditory stimulus from the video made him realize how it could have affected students and what he needed to improve.

> I feel like it is one of the major things I need to work on. I really felt bad for the students that missed out on that part of the lesson…I was not able to directly talk to the student and let the ones that could not hear me understand the points that I was making clearly. I was walking around stopping at different desk so I know they could hear me, but not that well. A student with a different culture may feel ignored and left out.

In addition, Elliot valued student understanding and the opportunities he could have provided for them to learn.

> As a teacher I value the level of understanding that I can give out. I want everyone to have the same opportunity to learn and prosper. If they are left out of the lesson they may feel bad about themselves and not care about learning other things that they may have otherwise cared about.

Elliot's reflection on the video of his teaching (RoA) made him aware of what he should

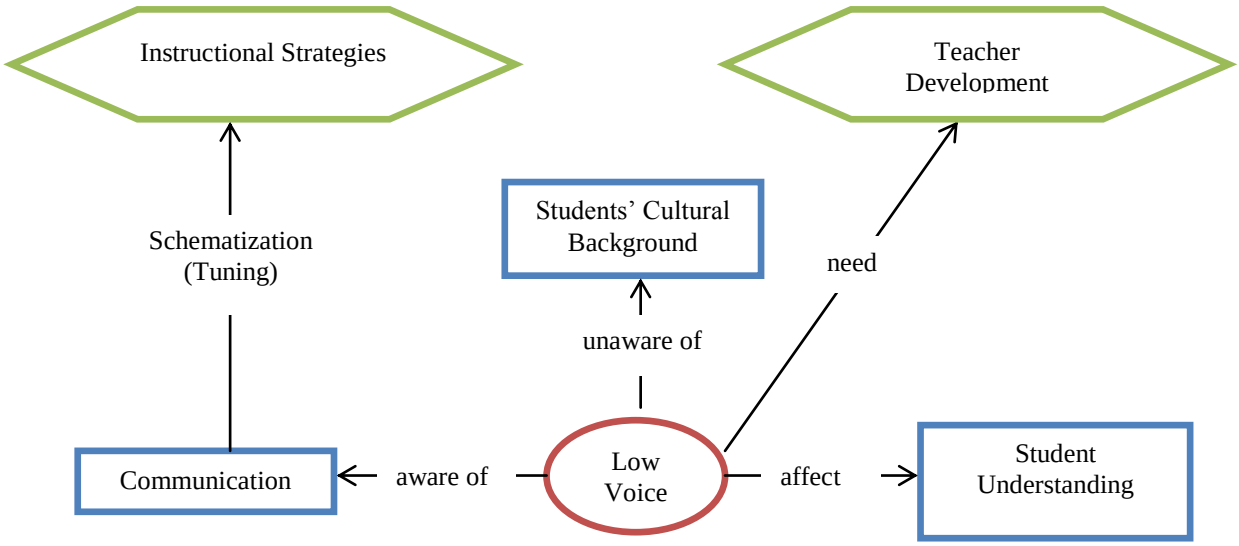

Figure 7. Elliot's Foci of Reflection and VAST Evidenced in the Example CIR

do to improve his performance in the future (RfA): "I have started practicing being louder. I am looking up some voice courses online and locally to see if I can improve." In addition, he realized that he needed to adjust his instructional strategies. "I am also going to stand closer to the center of the room when I am talking."

In his video-aided reflection, Elliot's was able to make connections among some elements related to teaching and learning, such as instructional strategies, learner development, learning differences, including cultural background, as well as professional learning (*see* Figure 7). He realized that students at the back could not hear him well, which could have affected their understanding of the subject. Students from a different background could feel that they were ignored. With the realization of what he needed to improve, Elliot was looking up some training to help improve his performance in his future teaching. Elliot experienced schema tuning in his video-aided reflection because the auditory stimulus of not talking loud enough caused him to accommodate his existing schema that he was not a soft speaking person to incorporate the new information that he

was not talking in a way that every student in the class.

CIR Form # 2. In this incident Elliot planned to have an interactive session to increase students involvement by using a graph on the white board in the front of the classroom, which was hard to see from the back of the room.

> I wanted the have an interactive session with the students. The idea was to have the student come up to the board and draw a couple of different kinds of paths on the board… The only corner of the board available was on the far side of the front and not very well lite. Once again I felt bad for the students who had to strain to see what was going on up there.

He realized how that could have affected student learning because some of the students were not engaged because they were not able to see what was on the white board.

> I felt bad when I discovered that some of the class was not with me. As a teacher I value the level of understanding that I can give out. I want everyone to have the same opportunity to learn and prosper. If they are left out of the lesson they may feel bad about themselves and not care about learning other things that they may have otherwise cared about. There is a balance that I have to find between personal involvement and function. I'm sure I can find a comfort level at the overhead machine.

Elliot's reflection on the video of his teaching (RoA) helped him make the connections between the inappropriate use of the white board and other elements of teaching and learning, such as instructional strategies, including use of technology, and learning environment to engage student. He, however, did not find a positive solution to solve the problem (RfA). He simply chose not to use the white board although he did mention that using the overhead could be an option. He also mentioned that he was not comfortable using the overhead or any technology in his class: "As a Teacher I will not be using the front board [the white board in the front of the classroom] again, if I can help it. I have started practicing with the overhead. There is a balance that I have to find

between personal involvement and function. I'm sure I can find a comfort level at the overhead machine".

Elliot was able to make an addition to his existing schema, which was using technology in a way that could enhance student learning; therefore, his schema changed by schema accretion. He wanted to use the white board to create an interactive session so that students could use the white board to draw different kinds of paths on the board. His intention was to engage student in the class. The result, however, did not turn out to be what he had planned because the white board was too far for students at the back of the classroom to see. Instead of finding a solution about how to use the white board effectively, Elliot simply chose to try out using the overhead although he though "it would be a lot more impersonal if I used the overhead".

CIR Form # 3. This incident helped Elliot identify that he and his peer "denied the students the opportunity to experience doing that".

> The incident involved a plastic bag and a glass jar that the students were supposed to put together themselves, but because we were nervous, we put the bag on the glass ourselves before we brought it out. So, we basically denied the students the opportunity to experience doing that.

Although Elliot thought it was just a minor thing, students could have learned something from doing it.

> I feel like it is one of the minor things that could have gone wrong, but if too many minor things go wrong you're in trouble. I really felt bad for the students that missed out on that part of the lesson.

He further explained how the incident could have affected students: "If they are left out of an experience they may feel bad about themselves and not care about learning other things that they may have otherwise cared about". The future action he planned to take was to start practicing his lesson plan more.

Elliot's reflection on the video of his teaching helped him make connections between planning for instruction and instructional strategies with student learning, particularly learning opportunity or meaningful learning. Elliot experienced schema accretion in his video-aided reflection because he added to his existing schemata of planning for instruction the new information of creating meaningful learning experience for students.

CIR Form # 4. This incident helped Elliot notice that he sat on a chair and let his peer take charge. He also realized what he was to do to improve.

> As a teacher, I should be judged as a professional and not sit down on the job. Plus I could not see what was going on in the class. I could have been walking around the room helping the student understand the lesson.

Elliot's reflection on the video of his teaching helped him realize that as a professional he was not supposed to sit in the classroom and let his peer take the responsibility of teaching. He experienced schema accretion because he added to his existing schema about the teaching professionals the new information that as a teacher, he was and was not supposed to do in the classroom. Table 10 summarizes Elliot's schema development and VAST.

Table 10

Elliot's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 2, 3, 4) -Schema tuning (CIR form: 1)	N/A
VAST	-Schematization	N/A

Summary

To sum up, Elliot focused on some elements that were related to teaching and learning when reviewing videos of his teaching and reflecting on his teaching experiences captured in the videos, such as planning for instructions, instructional strategies, communication, learner differences, and professional learning. The instructional strategies included different elements, such as communication and technology, creating a learning environment that supports learning. His video-aided reflection on his teaching practices (RoA) helped him realize what needed to be improved in his teaching and how to improve it (RfA). He was able to make some connections among the elements related to teaching and learning and was able to adjust or expand his existing schemata about teaching and learning through schema accretion and tuning.

The level of knowledge Elliot demonstrated in his CIR forms is mostly data and information because most of his knowledge about teaching and learning were raw and incomplete, with some of it contextualized. The phases/levels of learning he showed is initial to intermediate or image to schema because most of his information about teaching and learning was isolated facts or pieces of information with some being concrete and contextualized, as are demonstrated in the rectangle and hexagon shapes in Figure 7. Therefore, Elliot experienced initial phase or image level toward intermediate phase or schematization level of learning. Elliot was at the developmental stages between mostly one and two, with a few evidences in stage three because his reflection focused mostly on himself and the immediate concern for survival and class control, with some evidences on developing instructional strategies.

Emily

Introduction

Emily is a White female between the age of 51 and 60. She had no previous teaching experience besides some substitute teaching experience. The subject she was teaching was 7th grade math and science. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching and two from the video of her peer teaching in Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below. In addition, Emily also participated in the interview

Emily's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 22 to 23 minutes into the video. In her video-aided reflection, Emily focused on instructional strategies, including collaboration, higher-level thinking, communication, technology, and time management, learner development, learning differences, and learning environment.

CIR Form # 2: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 40 to 50 minutes into the video. In her video-aided reflection, Emily focused on content knowledge, learner development, learning differences, instructional strategies, and a learning environment that could engage and motivate students and support meaningful learning.

CIR Form # 3: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between eight minutes into the video and continued to the end of the video. In her video-aided reflection, Emily focused on learner development, learning differences, instructional strategies, especially management, and a learning environment that could engage, challenge, and motivate students to learn.

CIR Form # 4: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between 11 to 13 minutes into the video. In her video-aided reflection, Emily focused on learner development, learning differences, instructional strategies, such as management and communication, and a learning environment that could engage and motivate students to learn.

CIR Form # 5: This incident described in her CIR form of the practicum teaching in Spring 2012 occurred within the first eight minutes into the video. In her video-aided reflection, Emily focused on planning for instruction, instructional strategies, and a learning environment that could engage students and encourage.

Emily's VAST

CIR Form # 1. The video described in her CIR form #1 helped Emily notice her performance in the classroom that she could not have recalled without it. Just as she wrote: "There are many incidents in this video that I am thankful to have had the opportunity to review". In her video-aided reflection, Emily was asking questions because she believed that by asking questions she could "keep students thinking and engaged, while what really astonished her was how her response to a girl sitting in the front when she tried to answer her question.

> There was one student in the front row that kept raising her hand to answer any and all questions, and I called on her several times…. I asked a question and she, again, raised her hand. My response was "someone else this time", and I moved on to another student for a response.

Emily explained that she was feeling rushed, behind schedule and anxious about being evaluated by her supervisor, so she was thinking more about herself than the student. She added, "It was perfectly acceptable for me to call on someone else, but I should not have said anything to her".

Emily's video-aided reflection helped her realize what she did wrong (RoA) and what she needed to do to improve her future teaching (RfA). She realized what she did not handle the situation properly.

> I value the humanity of my students. I value who they are and what they bring to the class. While I was aware of the fact that there is not enough time in one classroom setting to give every student a voice, I believe all students have something important to say. In my nervousness and sense of general insecurity, I silenced a voice that should have been respected. As an educator, I believe I should have been more aware of the dynamics of my classroom.

In addition, Emily explained what she could have done to approach the situation, with specific information about how she would do differently. Moreover, she also stated that she was going to record her teaching for the purpose of her own personal and professional growth.

> I learned that watching myself teach a class of students is extremely useful in my personal growth – both as a person and a teacher. I will strive to pace my teaching into timed segments so I will not feel rushed and more focus on where the lesson is headed instead of where we are in the lesson at that moment. It is my job and my privilege, as an educator, to provide a safe environment for all children to learn. It is also my responsibility to always remember the developmental and educational needs of my students and to be mindful of the words I speak. Though I cannot call on all students, all students should feel that I value what they have to say. I should have kept quiet and then called on another student, or I should have thanked her for volunteering but suggested that we let others have a turn. I know I will make more mistakes, but I work to learn from my mistakes.

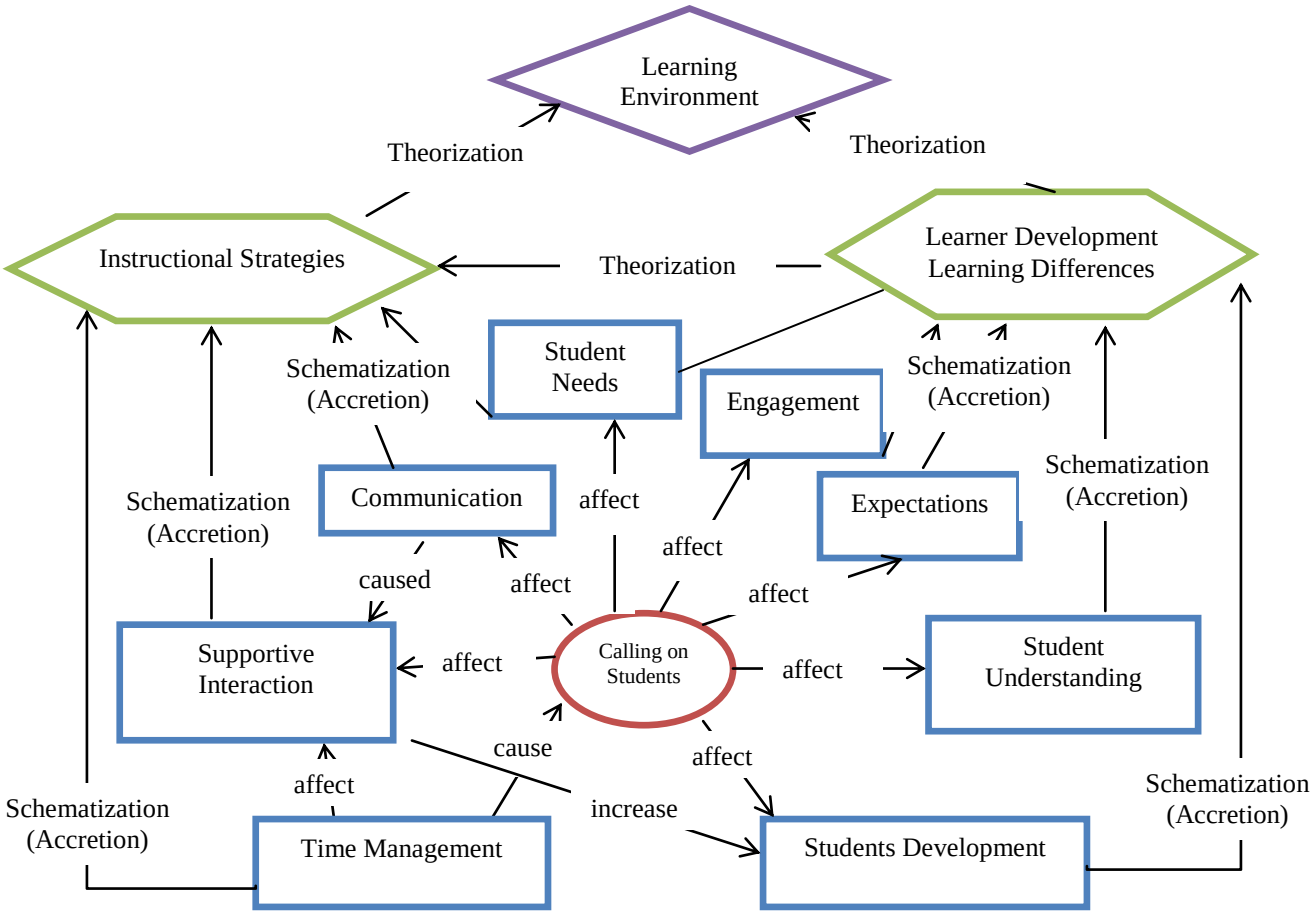

Figure 8. Emily's Foci of Reflection and VAST Evidenced in the Example CIR

Emily's reflection on the video of her teaching helped her make rich connections among the various elements in teaching and learning, such as instructional strategies, including time and classroom management, learner development, learning differences, and a learning environment that could support learning of all students (*see* Figure 8).

The visual stimulus of her not calling on the student and how she responded to the student made Emily realize that her action could have affected the student in different ways in terms of instructional strategies and learner development and learning differences. For example, she could have disengaged the student, affect her understanding of her expectations and student needs, understanding and development. She could have

communicated her expectations in a more supportive way. In addition, she could have had a better time management. Emily experienced schema accretion in her video-aided reflection because she added to her existing schema of instructional strategies the new information that she needed to communicate her expectation in an appropriate way and respect the input of all students.

CIR Form # 2. In this incident Emily noticed from the video that a male student in the front row was never on task and never engaged during the task portion of the class when other students were working either individually or in groups. She never paid attention to him. She realized that she could have done something to engage him, but she had been told not to spend too much time with any one student. "I should have been more aware of each individual student within the greater group. I feel frustrated because I am not sure what I could have done to make him be engaged in the task." She realized that the student deserved her attention and deserved to have a one-on-one time with her. She should have provided him with an alternative activity that might have made more sense to him. Or she could have asked somebody else to help him.

> Maybe there is a student or group of students that he has a connection with that would motivate him to do the assigned tasks. Maybe his other teachers have better ways of helping him that would help me to help him with learning science.

Emily's reflection on the video of her teaching helped her make connections among the various elements related to teaching and learning, such as content knowledge, instructional strategies, learner development, learning differences, and a learning environment that could engage and motivate every student in meaningful learning. Emily experience schema accretion in her video-aided reflection because she added to her existing schema of teaching the new information that she needed to create an engaging

and meaningful learning environment to support the learning of all students despite their development and learning differences.

CIR Form # 3. In this incident, Emily noticed from the video that one of the students was not engaged in the class because she "spent most of the time resting her head on her hands and displayed little or no interest." The visual stimulus from the video made Emily wonder what she had done wrong (RoA) and how she could fix it (RfA). She valued engaging all students in meaningful learning and realized that she could have done something to engage the student.

> I believe it is important to make sure all students are engaged in learning and motivated to learn. I also believe students need freedom in the classroom environment to take risks in learning. Risk taking in the classroom includes having the ability to try new learning strategies without the burden of having to worry about what others think or what they will say. All students are diverse, not only in their personal lives, but also in their learning needs and abilities. A good educator will recognize that students need variety in their learning experiences as different students learn best in different ways.

To improve her future teaching, Emily decided to continue to study and learn by reading books and attending seminars in order to become a better teacher. She also wanted to provide students with a lesson that enabled them to demonstrate content knowledge in a format free from rote learning. She would allow student to work either in groups or individually and to allow them choose from a list of ideas.

Emily's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as learner development, learning differences, a learning environment that could engage, motivate, and challenge the learning of all students, and professional learning. Emily experienced schema accretion in her video-aided reflection because she added to her existing schema of

teaching and learning the new information of supporting the learning of all students despite their differences in development and learning.

CIR Form # 4. In this incident, Emily noticed from the video that she seemed to be rushed in her instructions. She was not able to provide students with immediate access to highly detailed information about the required task. Some students needed more time to process information, while others needed more specific models to follow (RoA). She should have made sure this was accomplished right from the start. She also explained that what she needed to do to improve her teaching (RfA).

Emily's reflection on the video of her teaching helped her make connections among such elements of teaching and learning as learner development, learning difference, instructional strategies to communicate her expectations of students, and a learning environment that could motivate students to learn. Emily experienced schema accretion in her video-aided reflection because added to her existing schema of teaching and learning the new information of taking into consideration learner development, learning differences, and instructional strategies that could support the learning of all students.

CIR Form # 5. In this incident, Emily noticed that she lost her focus in the class due to an emergent change of the class. What made it worse was that she was required to teach using the mentor teacher's style, which was rote learning (RoA). The conflicting interests in teaching put her into a dilemma.

> I was only rarely allowed to teach in the style I prefer: constructive learning. My mentor teacher was a lecturer and that is how she wanted me to teach, so I knew the students were going to fidget, talk, and become easily distracted.

She also added that she tried to incorporate the initial concepts into the new concepts with as much fluidity as possible (RfA) because

> Most of the students had some form of learning disability…. it is important that I am able to relate to my students and to understand their individual learning styles and needs. It is also important that students recognize that my true role in their learning is that of a facilitator and that I, too, make mistakes.

She further elaborated that if allowed she wanted to fully engage students in learning and lecture as little as possible (RfA)

> I want my students to be excited to come to my class and excited to learn. If my students do not learn, it is not because they cannot learn. It is because I have not provided the proper environment and/or a well-prepared and engaging lesson. If I always place the needs of the students before my own, provide them with an engaging learning environment, and treat my students the same way I expect them to treat me, I will be on the way to becoming the best that I can be in the classroom.

Emily's reflection on the video of her teaching helped her make connection among different elements of teaching and learning, such as planning for instruction, instructional strategies, including mode of teaching, learner development, learning differences, a learning environment that could encourage inquiry and engagement. Emily experienced schema accretion by adding to her existing schema of instructional strategies the new information, which was taking into consideration of learner development, learning difference, and an engaging and supportive learning environment. Table 11 summarizes Emily's schema development and VAST.

Summary

To sum up, Emily focused on various elements related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences

Table 11

Emily's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4)	-Schema accretion (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

captured in the video, such as planning for instructions, instructional strategies, learner development, learning differences, and learning development. The instructional strategies included different elements, such as time management and communications of expectations in order to create a learning environment that encourage inquiry, and meaningful learning.

Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to be improved in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed her knowledge through schema accretion. Although Emily only experienced schema accretion in her VAST in both of the semesters, there was an obvious change in Emily's VAST in Spring 2012 compared with that in Fall 2011, which was she was beginning to question the decision of the authority. She added a new element into her existing schema that school authority could indirectly affect student learning and the choice of instructional strategies.

The level of knowledge Emily demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 8, with some of the information integrated and logically ordered schemata as shown in the shapes hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Daisy was at developmental stages between two and five because her reflection focused on fitting into school, developing teaching strategies, student learning, and learning environment.

Kate

Introduction

Kate is an Asian-Pacific Islander female between the age of 22 and 25. She had no previous teaching experience. The subjects she was teaching on the videos were 6th and 4th grade science and math. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The four CIR forms, which were collected in Fall 2011, described four critical incidents: two from the video of her practicum teaching and two from the video of her peer. The one collected in Spring 2011 is about the video of her practicum teaching. These CIR forms are presented in the chronological order below.

Kate's Foci of Reflection

CIR Form # 1: This incident described in this CIR form of her practicum teaching in Fall 2011 occurred within the first minute of the video. In her video-aided reflection, Kate focused on instructional strategy and student learning.

CIR Form # 2: This incident described in this CIR form of her practicum teaching in Fall 2011 occurred within the first minute of the video. In her video-aided reflection, Kate focused on instructional strategy and student learning.

CIR Form # 3: This incident described in this CIR form of her peer teaching in Fall 2011 occurred between one to three minutes into and throughout most parts of the video. In her video-aided reflection, Kate focused on teacher performance, students' perception of the teacher, student engagement, student learning, and the learning environment.

CIR Form # 4: This incident described in this CIR form of her peer teaching in Fall 2011 occurred within the entire video. In her video-aided reflection, Kate focused on teacher performance, lesson planning and student learning.

CIR Form # 5: Kate did not provide the time frame for this CIR form described in her practicum teaching in Spring 2012. In her video-aided reflection, Kate focused on teacher confidence, student learning, and teacher professional development.

Kate's VAST

CIR Form # 1. The video described in this CIR form helped Kate notice that she was very nervous and her nervousness affected her performance in the class. As she could not see the board at the back of the classroom, she had to try really hard, which made students feel that she did not know what she was teaching.

> During the class I felt very nervous and I could not see the back board. I try to focus really hard so that I could see the back board and read the numbers out loud. As I am watching the video, I see that I am also nervous while teaching the class. I see that students are attentive and listen but the nervousness causing me to not be able to see the back board.

Kate realized that she could have found a way to see the back board and to make good use of it. In addition, she was not paying attention to student needs and their learning since her only concentration at that moment was trying to read the board: "I felt that I did not give enough attention to some students. I need to be more aware of shy students. I also need to be aware that I could not see the backboard".

Kate's reflection on the videos of her teaching helped her make connections between the different elements of her performance in the class and student teaching, such as instructional planning and strategy and student learning (*see* Figure 9). The visual stimulus that she had a hard time seeing what was on the board at the back of the room due to her nervousness made her wonder how that could have affected student learning and how she could improve her instructional strategies and make better use of classroom

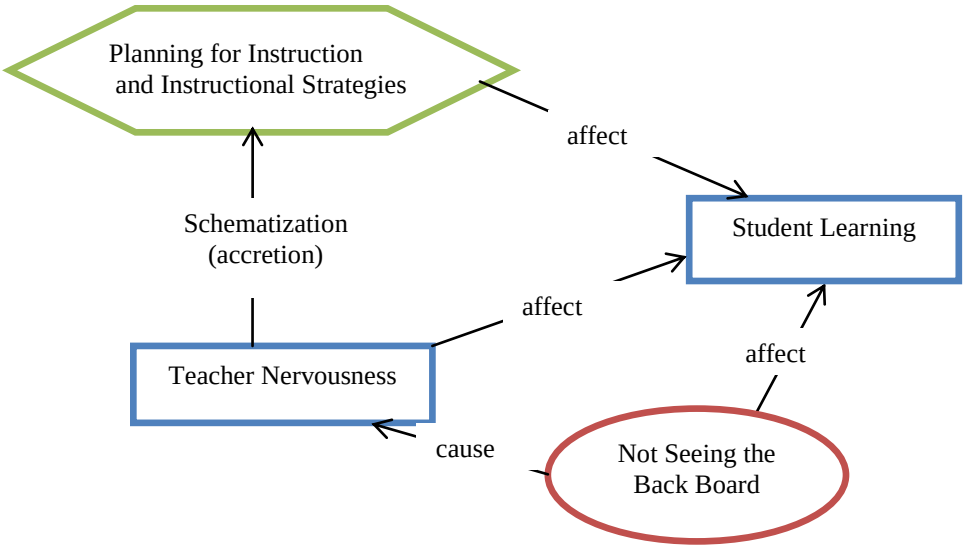

Figure 9. Kate's Foci of Reflection and VAST Evidenced in the Example CIR

resources and technology. The visual stimulus also caused Kate's schema to change through schema accretion. She added to her existing schema the new information of the appropriate use of the classroom resources in her lesson planning.

Kate's video-aided reflection on her teaching experience helped her understand what improvement she needed to make (RoA) and how to do it in her future teaching (RfA).

> I will be more responsive in students learning by creating a better sight to look at the backboard. I need to show more understanding in the content. Some improvement that I need to do is providing a better understanding of the lesson. I would do differently in the future is moving the backboard or move closer to the backboard as I read the questions aloud.

CIR Form # 2. The incident described in this CIR form helped Kate notice that she could not pronounce the word "numeral" correctly, which was caused by her nervousness. "During the class period, I notice that I did not say "numeral" correctly. … I looked nervous; therefore I could not say the words correctly". She realized that her nervousness was affecting her performance in the class and that she needed to be less nervous and more active in teaching: "I need to be less nervous because the more nervous I become, the more uncomfortable students will feel". She was also aware that she needed to be more accurate in her communication with her students and explained the reason:

> I need to be more aware of what I am saying around students. Since these are young students, they are more like a sponge and they can soak up any words you are saying. I do not want to confuse students between words and make them feel uncomfortable in learning the vocabulary.

Kate' reflection on the video of her teaching helped her make connections between communication and student learning.

> I have clearly identify [sic] how nervous I was …. When being nervous, my speech pattern will not be up to part and the responsive from students will be less because they will not understand the lesson or the vocabulary.

The visual stimulus of her nervousness caused Kate's schema to change through schema accretion. She added to her existing schema the new information that she needed to pronounce vocabulary accurately to improve her communication with the students. Kate's video-aided reflection on her teaching experience (RoA) helped her understand what improvement she needed to make and how to do it in her future teaching (RfA), which was overcoming her nervousness and improving her communication.

CIR Form # 3. The video described in this CIR form was about Kate's peer teaching experience. From this video, Kate noticed that she was standing behind a desk most of the time during the teaching and looked nervous, which also made the students nervous because she was not with them. Kate explained, "Standing behind the desk is good because it allows you to see the entire class. It also allows you to look at all students' emotions." Although Kate gave a reason for standing behind the desk, she did realize it was a mistake:

> Students would not be at a high active level. This creates a nervous of both teacher and student. When I stand behind the desk too long … I look nervous. Students also look nervous and confuse because I was not with them during the teaching.

She was also aware that students needed to "feel comfortable learning and with a fun learning environment".

Kate's video-aided reflection on her teaching experience helped her understand what she needed to improve (RoA) and how to make the improvement in her future teaching (RfA).

> I should have been more alert in how students feel toward me standing behind the desk. I did not fully understand how the factors in the classroom environment affected these students' learning that day because I was standing behind the desk. I should have walked around the class and adapt to students. I should have come close and get to know students' learning style. I will keep this standard in mind and practice more in how I teach and how I want to relate to teaching.

In addition, Kate's video-aided reflection helped her make connections between her standing behind the desk with students' perception of the teacher: teacher looking nervous, student engagement: students' feeling nervous and uncomfortable, student learning: students feeling confused, and the learning environment: not supportive and no fun, and how these elements could have affected each other. Just as she elaborated:

> I did not feel that my students were comfortable in learning while I was standing behind the desk. … My students were nervous and afraid to ask questions…. Since I stand behind the desk to give instruction, it will make students distracted from learning because it creates the emotion of scare and afraid.

The visual stimulus triggered a change in Kate's schema by schema accretion, or the addition into her existing schema of the newly-acquired information: being better involved in student learning by mobilizing more in the classroom and paying more attention to students' learning: "I want to improve by walking around the class next time. I would improve my teaching style asking students one-on-one and creating a relationship where students will feel comfortable learning."

CIR Form # 4. The video described in this CIR form, was about Kate's peer teaching experience. When reviewing this video, Kate noticed that she was not speaking much since most of the time her peer was teaching. She felt that she was not given the credit and ownership she deserved.

> Since this is team teaching, we should do better in dividing the work and the lecture part. I did not speak much during teaching…. The only role I had was planning the lesson and did not have a role of speaking…. I did not walk around

> or jumped in. I did not have a role as a teacher. I only stand behind the scene and does the technology stuff.

Kate's video-aided reflection on her teaching experience helped her understand what she needed to improve (RoA) and how to make the improvement in her future teaching (RfA): she needed to be more involved and responsive in the students' learning.

> By teaching the child and not being in the back, I feel as if I could respond to their learning. I want to teach students and plan effectively by having a role in the teaching. When I have a role in the teaching the child will be more sensitive, alert, and responsive in all learning.

She was also able to find a solution to fix the problem in her future lesson planning to give every member in the team ownership of their team work.

> I believe that I do not give [sic] any teaching role in this experience. I only give the planning which contains the background of how to teach but I did not make it clear on how to divide the roles. The main believe that as an educator I should be providing the same role as the main teacher…. I will plan better. I will try to divide the roles more even….

With the help of the video, Kate was able to make connection between her performance in the lesson and lesson planning and student learning.

> By teaching the child and not being in the back, I feel as if I could respond to their learning. I want to teach students and plan effectively by having a role in the teaching…. I wish that I would have done more planning and better activities with incorporate my teaching into the class.

The visual stimulus of the video triggered a change in Kate's schema by schema accretion, or an addition to her existing schema the new information: being more involved in teaching as a team by clearly dividing the roles of the team members in lesson planning and giving every member in the team the sense of ownership.

I inferred that Kate was not given a role in the lecture of the lesson possibly due to her being a non-native speaker of English, which might have explained why she was

behind the scene and did all the planning, but not giving the ownership she should have been credited to.

CIR Form #5. The incident described in this CIR form helped Kate notice that she felt calm and confident while she was giving an introduction and review of the lesson: "I felt calm and confident…. I spoke very nervous, but I did not allow the nervousness to overcome my fear to teach". Kate realized that her confidence as a teacher could affect her interaction with the students:

> As a teacher, this incident shows that I believe I can do anything I put my mind to. In that aspect, I will show that I can overcome the fear of nervousness and teach students with confident….I also believe that students will be more appreciative of a teacher when a teacher is more confident in the subject matter and the speaking matter.

Kate's reflection on the video of her teaching (RoA) helped her make connections between her confidence as a teacher and student learning as well as her professional development: "I also believe that all students can learn when a teacher is confident in his [sic] or herself" as well as teacher professional development.

The visual stimulus of the video triggered a change in Kate's schema by schema accretion. She added to her existing schema the new information that her confidence as a teacher could enhance students' learning. Moreover, she was able to elaborate on the specific tactics that would use in her future to show her confidence in her teaching (RfA).

> This incident directs me to improve in my confident and become a better teacher. To improve, I will practice more and take each practice to the highest level. I will do differently next time I practice teaching. I will be calm and look at the students as learners and those who want to learn and not look at them as "all eyes on me." As I watch the video, I was impressed at myself that I could stand up there and teach. I feel very confident and matured.

Kate mentioned in the CIR form that her partners, who collaborated with her in her video-aided reflection, helped her establish her confidence:

> My cohort (names omitted here) has helped me overcome my nervousness by telling me to stay calm when I teach. We talked about how I speak in front of the class and how I can remain calm and be myself when I teach. I realized that when I am myself, students will like and understand to learn more
> .

Kate's video-aided reflection had helped her to improve her future teaching.

> Overall, I am more confident now and I will be more confident in the future. Through the critical incident video, I have learned about my style of teaching and I need to improve on confident and being calm while I teach.

Table 12 summarizes Kate's schema development and VAST.

Summary

To sum up, Kate focused on some elements that were related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions and instructional strategies. The Instructional strategies included different elements, such as communication and technology. Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to be improved in her teaching and how to improve it (RfA). She was able to make some connections among elements related to teaching and learning and was able to expand her existing schemata about teaching and learning

Table 12

Kate's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4)	-Schema accretion (CIR form: 5)
VAST	-Image -Schematization	-Image -Schematization

through schema accretion. Although Kate only experienced schema accretion in her VAST in both of the semesters, an obvious development was evidenced in Kate's CIR forms. In Spring 2012, Kate made more connections among various elements about teaching and learning.

The level of knowledge Kate demonstrated in her CIR forms is mostly data and information because most of her knowledge about teaching and learning were raw and incomplete, with some of it contextualized. The phases/levels of learning she showed is initial to intermediate or image to schema because most of her information about teaching and learning was isolated facts or pieces of information with some being concrete and contextualized, as are demonstrated in the rectangle and hexagon shapes in Figure 9. Therefore, Kate experienced initial phase or image level toward intermediate phase or schematization level of learning. Kate was at the developmental stages between mostly one and two, with a few evidences in stage three because her reflection focused mostly on herself and the immediate concern for survival and class control, with some evidences on developing instructional strategies.

Lance

Introduction

Lance is a White male between the age of 41 and 50. He had no previous teaching experience. The subject he was teaching was 4th grade social studies and science. The data collected from him included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of his practicum teaching, two from the video of his peer teaching in Fall 2011, and one from

the video of his practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below.

Lance's Foci of Reflection

CIR Form # 1: This incident described in the CIR form of his practicum teaching in Fall 2011 occurred between one to four minutes into the video. In his video-aided reflection, Lance focused instructional strategies, such as classroom management, learner development, and learning environment.

CIR Form # 2: This incident described in his CIR form of his practicum teaching in Fall 2011 occurred between six to nine minutes into the video. In his video-aided reflection, Lance focused on instructional strategies, such as classroom management, and student learning.

CIR Form # 3: This incident described in his CIR form of his peer teaching in Fall 2011 occurred within the first 29 seconds into the video. In his video-aided reflection, Lance focused instructional strategies, such as communication, classroom management, teacher-student relationship, student behavior, student learning and learning environment.

CIR Form # 4: This incident described in his CIR form of his peer teaching in the fall of 2011 occurred between 13 and 14 minutes into the video. In his video-aided reflection, Lance focused on instructional strategies, such as classroom management, and student learning, including student engagement,

CIR Form # 5: No time frame was provided for this incident described in his CIR form of his practicum teaching in Spring 2012. In his video-aided reflection, Lance focused on planning for instructions, instructional strategies, including classroom

management, and learner development, learning differences, such as student understanding, assessment, and student engagement.

Lance's VAST

CIR Form # 1. The video described in Lance's CIR form #1 was about his practicum teaching experience. In the lesson, students were divided into 5 groups to work on a boat activity, in which they worked together to sort the slips into true facts about Columbus and false facts and put the true facts on the sail of the boat and false facts off the boat.

When reviewing the video, Lance noticed that students "were a little confused about what was expected from them…. Some students did not understand the directions clearly like I thought they did"; thus, they became off task. Instead of working on their group project, some of the students began to talk about things that were not related to what they were supposed to do. After he spotted students' confusion and off-task activities, Lance walked around, trying to alleviate the problem, but was unable to cover all groups:

> I walked around to the groups to encourage them to discuss and work as groups to see what was false or true about Christopher Columbus. There was some times when students were off task and I went to those groups ask them questions to get them back on task. I realized that I did not get to all groups and I should spend more time with some groups.

The video-aided reflection helped Lance realize what he needed to improve (RoA) and how to make the improvements in his future teaching (RfA).

> I should have slowed down and explained the activity better and asked the students if they had any questions about the activity…. I should have explained the activity better than I did. I thought that I could do a better job.

The visual stimulus of students' confusion caused Lance's schema change by schema tuning and accretion. He experienced schema tuning by adapting his existing schema to incorporate the new information, which is he thought he did a good job giving the instructions and he thought students were clear about the instructions because he overestimated students' ability to understand the instructions.

> In order for students to learn in social skills, intellectual skills, and personal development, they must understand directions in a clear matter…. The most important factor for students to learn is that teachers must know their students and their learning styles.

In addition, he added to his existing schema the specific strategies to ensure that students understood the instructions: "I should have spent more time with groups to make sure they understood the directions. I assumed the students understood what was expected from them in the boat activity". Lance's reflection on the video of his teaching helped him make connections between students' confusion and students' understanding, classroom management, instructional strategy, student collaboration and student learning (*see* Figure 10). Lance's reflection on the video of his teaching (RoA) helped him find out

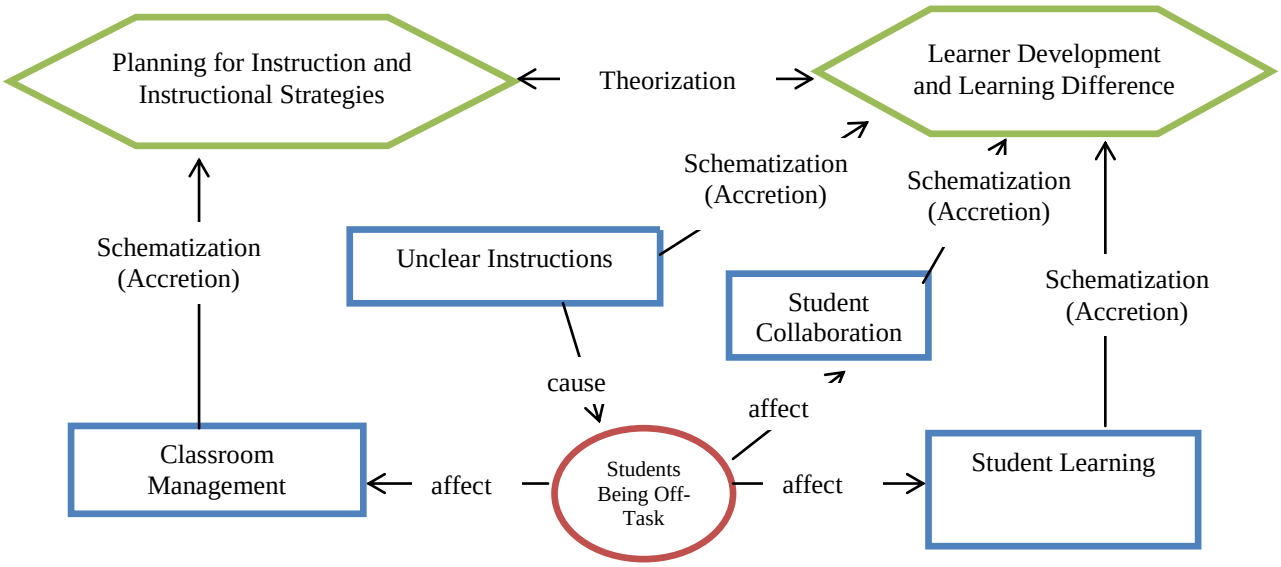

Figure 10. Lance's Foci of Reflection and VAST Evidenced in the Example CIR

what specifically he needed to do to improve his future teaching (RfA).

> I will take my time explaining directions to make sure all students understand what is expected from them. I will make sure that I get to all students when they are in groups to see their progress. I will ask questions or allow the students to ask questions about any assignment before they begin their assignment.

Lance's reflections on his teaching experience helped him better understand the connections among the different elements in his teaching. The visual stimulus that students were off task caused Lance to re-think about the instructional planning and strategies he used in class and how they could have affected students. He realized that students went off task because the instructions were not clear and beyond their comprehension. Lance was able to make connections among the elements of student engagement, instructional strategies, and learner development. In addition, he also made connections among classroom management, student collaboration, and student learning. In terms of his schema change, he added to his existing schema the new information by adapting and adding to his existing schema the new information of implementing more effective instructional and communication strategies to ensure students' understanding.

CIR Form # 2. The incident that was described in this CIR form also happened in Lance's practicum teaching in Fall 2011. In this incident, Lance noticed that students were engaged in the activities they were doing in groups.

> As I walked around watching the students trying to figure out what was true or false about Christopher Columbus, some were working well. Some students were discussing what needed to go on the false or true sail of the boat. Some were exploring why some things are true and false. Even some students got into a debate about some things Christopher Columbus did or did not do.

He, however, were not engaged in what students were doing as a teacher. He walked a lot around the classroom, but never spent much time with any group to assess their

understanding and ensure they were on task. He also realized how his lack of involvement with student could have affected students' learning.

> I was walking around the class room watching the students working in their groups. I noticed some working hard and others were socializing in their groups. Some students were getting their assignment done and others at times were struggling to stay on task.

Lance's reflection on the video of his teaching (RoA) helped him make connections between his action in the class and classroom management and student learning. He noticed that his lack of engagement with students could have affected their learning and realized what he needed to improve in his future teaching (RfA), which is, to be "more engaged with the students throughout the activity". Lance experienced schema accretion because he added to his existing schema the new information of being more engaged in student activity.

CIR Form # 3. The incident described in this CIR form happened in Lance's peer teaching in Fall 2011. When reviewing the video, Lance noticed that he was using the language that he was supposed and it could have created problems in the class if he were teaching real students in school:

> The incident … would be a major problem if the students responded to what I had said: 'Take the water and do anything with it'…. This would have caused total chaos if the students had broken out into a water fight.

The video-aided reflection (RoA) helped Lance realize that he should have been more careful with his language in order to create a positive learning environment (RfA).

> The statement I said did not produce a positive environment for the students. I should be more careful of what I say in the classroom because it will affect the classroom in a positive way or in a negative way.

Instead of using inappropriate language, a teacher should use language in an appropriate way that could encourage critical thinking, students learning, meaningful learning as well as a positive relationship with students.

> I believe the words used in a classroom are important. Using words in the right way or wrong way can change circumstances with a student as quick as a blink of an eye. One important factor to remember about using word; in a classroom is that the words must be real in order to produce critical thinking. Using words in a correct way can open up doors to help students experience a meaningful learning experience. There is trust and relationships that is built through words. The main thing I learned in this incident is the value of how a teacher uses words.

Lance's reflection on the video of his teaching helped him make connections between his use of language and other elements that could have been affected by it, such as student behavior, classroom management, teacher-student relationship, student learning and learning environment. Moreover, Lance was aware of the importance of using the right words in a class.

> I will be more careful of how I us words in all circumstances in a classroom because it will have an effect on students. The most powerful tool a teacher has is words. Words will give a teacher a positive or a negative classroom setting.

Lance experienced schema accretion because he added to his existing schema the new information of using language appropriately to cultivate a positive classroom setting and learning environment for his students.

CIR Form # 4. The incident that was described in this CIR form happened in Lance's peer teaching in Fall 2011. When reviewing the video, Lance noticed that he was standing behind the desk doing nothing when Daisy, his peer, was explaining the difference of oceans. Lance's reflection on the video of his teaching (RoA) helped him realize that he should have taken a more active role in the peer teaching to ensure students were engaged and active in their learning (RfA).

> I was watching Daisy explain the different oceans and I was just standing behind the desk doing nothing. I should have been asking some questions about the oceans while Daisy was writing the names of the oceans on the board. The oceans were a major part about the distributive of water and I should have seen if the students knew the importance of the oceans "prior knowledge". If I did this while Daisy was writing on the board, I believe there would have been more engagement during this time.

In addition to engaging students and assessing their understanding, Lance realized that he could have created a meaningful learning opportunity for students instead of being uninvolved.

> I should have asked more questions to give the students more of a learning experience. I should have made it a more meaningful lesson for the students and helped the students to make real life connections with the oceans…. . I want to give the students in my science class the freedom to express their curiosity and to ask questions and never assume anything in life. This is why I should ask more questions about what I am teaching about instead of standing behind the desk.

Lance's video-aided reflection helped him make connections between his performance and teacher participation, classroom management, student engagement, student learning and instructional strategy. In addition, he realized teacher participation played an importance role in students' learning experience. Therefore, in his future teaching, he would ensure that:

> I will be more engaged with my students and ask questions so the students will go beyond the surface. I will make sure they all understand the concepts and they have no doubt about what they are learning. I will make sure the students keep engaged by allowing them to ask questions or by asking questions to the students so they can put new knowledge on top of their prior knowledge.

Lance experienced schema accretion because he added the new information of teacher participation into his existing schema of instructional planning and strategies.

CIR Form # 5. The incident described in this CIR form happened in Lance's practicum teaching in Spring 2012. When reviewing the video, Lance noticed that he was lecturing most of the time and students were not engaged. He also elaborated on the

reason why he did not give student opportunity to actively participate in the lesson and how that could have affected students (RoA).

> I noticed that the students were not engaged enough in the lecture.... I was focusing on making sure that I include what needed to be taught and not really focusing on how the students feel during the lesson. It aggravated me tremendously when I saw myself get in a hurry to try to get things done in the lesson, rather than focusing on whether the students were getting it or not.

He realized, with the help of the video, that he could have made the lesson more interactive and more interesting by giving students the opportunity to ask questions and to have discussions between the student and himself in order to let students feel that their input and ideas were appreciated. Meanwhile he could have assessed students understanding and included a variety of activities to engage students:

> I need to allow the students to be more involved in the lecture and allow them to make comments. I should have more questions to see if the students understand the different bird beaks and this would engage the students more. I need some kind of mini activity to hook the students in order to get their interest about the bird beaks.

The video-aided reflection on his teaching experience helped Lance understand what improvement he needed to make (RoA) and how to make those improvements (RfA):

> This incident directs me to make sure that lectures are more interactive with the students. I will make sure to have some kind of activity that will hook them in order to keep their attention on the topic. I will also try to have a video that will enhance the knowledge on the topic.

Lance's reflection on the videos of his teaching helped him make connections between his performance in class and other elements that could have been affected by his performance, such as student engagement, classroom management, instructional planning and strategy, student understanding, student learning, and assessment. Lance experienced schema accretion in his video-aided reflection because he added to his existing schema

the new information of creating an engaging learning environment for students utilizing a variety of instructional planning and strategies.

In terms of reflection with the Critical Friend Group, Lance pointed out the pros and cons when collaborating with peers in his video-aided reflection. On the one hand, peers provided some good insights in his reflection: "The feedback from my critical friends group revealed some good insights that I will look at very closely when I teach a lesson'. In addition, peer's feedback helped him to look at things from a different perspective because:

> They might see something in the way you are teaching that they can suggest to you to make it a better lesson. Other people working with you are better observers because then you can have more than one opinion on how to go about teaching a lesson. Having more people involved in a lesson could be the difference between having a good lesson or a great lesson.

On the other hand, peer's feedback could become distractions due to the differences in terms of personality and teaching as well as how they got their points crossed.

> There can be some drawbacks in working collaboratively because there could be some personality differences. Each teacher has their own style of teaching and sometimes it just won't work out with another teacher. Sometimes allowing other teachers to watch you teach could become a distraction because some comments made by them are not always friendly criticism.

Table 13

Lance's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4) -Schema tuning (CIR form: 1)	-Schema accretion (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

Table 13 summarizes Lance's schema development and VAST.

Summary

To sum up, Lance focused on various elements related to teaching and learning when reviewing videos of his teaching and reflecting on his teaching experiences captured in the video, such as planning for instructions, instructional strategies, learner development. His video-aided reflection on his teaching practices (RoA) helped him realize what needed to be improved in his teaching and how to improve it (RfA). He made connections among the different elements that were related to teaching and learning, thus expanding his prior knowledge about teaching and learning. He constructed his knowledge through schema accretion and tuning.

The level of knowledge Lance demonstrated in his CIR forms is mostly information with some characteristics of theory because his knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning he showed is intermediate or schema toward terminal or theory because most of his information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 10, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, he experienced schematization and theorization in his video-aided reflection. Lance was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Mariah

Introduction

Mariah is a female between the age 31 and 40. Her ethnicity background was other. Her only prior teaching experience was working as a substitute teacher. The subject she was teaching was English and science at the time when the data was collected. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching and two from the video of his peer teaching in Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below.

Mariah's Foci of Reflection

CIR Form # 1: This incident described in the CIR form of her practicum teaching in Fall 2011 occurred between five to eight minutes into the video. In her video-aided reflection, Mariah focused on instructional strategies, such as classroom management, motivation, communication and technology.

CIR Form # 2: This incident described in the CIR form of her practicum teaching in Fall 2011 occurred between 24 to 26 minutes into the video. In her video-aided reflection, Mariah focused on planning for instructions and instructional strategies, including management, communication, and student development.

CIR Form # 3: This incident described in the CIR form of her peer teaching in Fall 2011 occurred between seven to 12 minutes into the video. In her video-aided

reflection, Mariah focused on planning for instructional strategies, such as communication, technology, and management.

CIR Form # 4: This incident described in the CIR form of her peer teaching in Fall 2011 occurred between 13 to 21 minutes into the video. In her video-aided reflection, Mariah focused on professional growth: reflective practice.

CIR Form # 5: This incident described in the CIR form of her practicum teaching in the spring of 2012 occurred between 11 to 20 minutes into the video. In her video-aided reflection, Mariah focused on instructional strategies, such as communications and technology and classroom management.

Mariah's VAST

CIR Form # 1. The video described in Mariah's CIR form #1 was about her practicum teaching experience. In the video, she was using a poster to teach 4th graders the water cycle. The video helped Mariah notice that she was blocking a group of students on her left as she was reading off the poster. The students were not able to see what was on the poster. She, as a teacher, "did not seem to notice that group at all during the explanation" as she was facing sideways, explaining the water blocked the poster while she was reading off the poster. As a result some students could not see what was on it. None of the students told her that they could not see the poster because they were shy. The video made Mariah realize that she needed to use media communication techniques more effectively in order "to create an environment where all of the students could participate". It also helped Mariah be aware that she "was not able to give students the chance to participate in discussion" because she "was not paying attention to that group."

Mariah's reflection on the video of her teaching (RoA) helped her make connections among various elements of teaching and learning. The visual stimulus that Mariah blocked the view of some students made her realize that those students could become disengaged and unmotivated in what she was teaching and that she needed to improve her classroom management and use of technology, such as re-arranging the layout of the classroom and by moving to the center of the class and using communication and technology to motivate students.

> It is also important to make sure that your classroom layout is good for when you stand in front of the class and explain things to students. If I had moved the group to my left and brought the desk more in the middle of the room then they would have been able to see me and I would not have left them out of the conversion.

In addition, Mariah came up with a supplementary plan (RfA) of using overhead to ensure that she could stand out of the way so that all students could see the visuals she

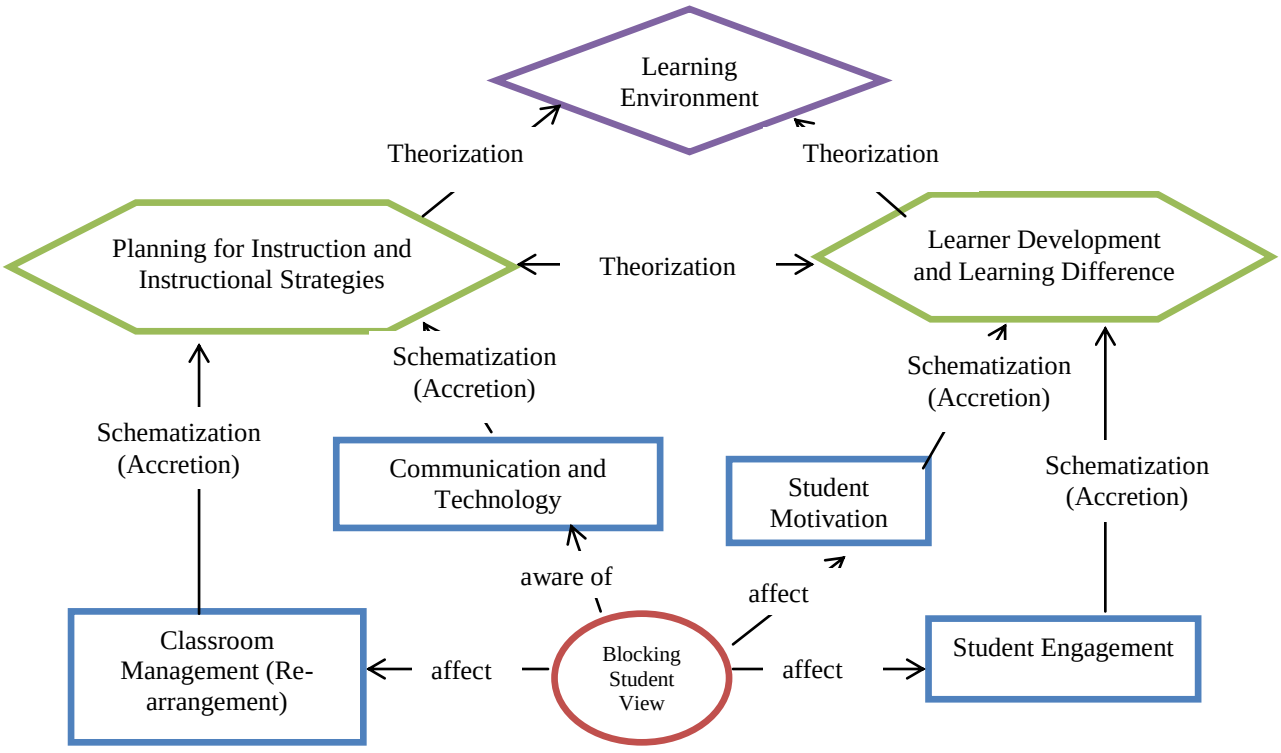

Figure 11. Mariah's Foci of Reflection and VAST Evidenced in the Example CIR

was discussion (*see* Figure 11).

Mariah experienced schema accretion in her video-aided reflection because she added to her classroom management schema the elements of re-arranging the classroom layout. In addition, she used resorts that belonged to another schema: communication and technology to help solve the problem she encountered in the video. Thus, she built up a connection or network between schemata, an evidence of theorization.

CIR Form # 2. The incident described in this CIR form also happened in Mariah's practicum teaching in Fall 2011. In this incident, the subject Mariah was teaching was about water cycle and the different states of water. She noticed that students seemed confused about what they were supposed to do: "They were all still confused I could see they still had many questions." She also had to make adjustment to the activity because some of the course materials were not in the right place. This incident helped Mariah realize that she should have used multiple instructional strategies to help students understand, such as modeling the activity, as well as be more specific when giving directions.

Mariah's reflection on the video of her teaching helped her make connections among various elements of teaching and learning, such as planning for instructions, and instructional strategies, including management, communication, and learner development. By reflecting on what she needed to improve (RoA), Mariah realized that "it is very important to explain things in a way in which all of the students can understand them" (RfA). Moreover, Mariah elaborated on what specifically she needed to do in her future to improve her teaching.

> I will try to explain and model things that may be complicated to the students so that they have an example to go by. I will also give students more explicit

> directions and use a timer so that the activities that I do seem more organized. The students will know when to switch from station to station when they hear the timer. This could help with the confusion.

She also needed to communicate in a way that "all of the students can get a better understanding of the directions". Mariah experienced schema accretion in her video-aided reflection because she added to her existing schema the new information of using multiple instructional strategies, better planning, communication and management to help students understand and learn the subject.

CIR Form # 3. The incident described in this CIR form happened in Mariah's peer teaching in Fall 2011. In this incident, the subject Mariah was teaching was rock cycle. When reviewing the video, Mariah noticed that she was standing in front of the classroom and pointing to the screen, and she looked nervous and uncomfortable, causing her to stumble on the words. She became nervous when nothing came up on the screen she was using. Her nervousness aggravated when she was not able to read what was on the screen due to the angle she was standing, and when the whole class paused for her.

Mariah's video-aided reflection on her teaching made her be aware of what she needed to do to improve her performance (RoA) and how to improve in her future teaching (RfA).

> I think that I could have moved away from the projection screen and walked around the classroom. I think this would have made me less nervous…. Now that I see what happened in my teaching video, I will be aware of where I stand and how well I can see. I think that another thing that would help me with this problem would be to have a remote control for the computer or slide show.

Mariah's reflection on the video of her teaching helped her realize the importance of using technology effectively in order "to create an environment so that all of the students could hear and understand me." For example, she realized that "it is important to make

sure that your classroom layout is good when you stand in front of the class and explain things to the students".

Mariah was able to make connections between her performance and other elements that were related to teaching and learning, such as instructional strategies, including the use of technology, classroom management, and learning environment. Mariah experienced schema accretion in her video-aided reflection because she added to her existing schema the specific information about how to use technology more effectively and what to do to overcome her nervousness.

CIR Form # 4. The incident described in this CIR form also happened in Mariah's peer teaching in Fall 2011. When reviewing the video, Mariah noticed that when she was giving verbal instructions step by step, students started to get bored and wanted to move on to the activity. The video changed Mariah's original thought about her teaching.

> At the time I thought I was doing the right thing by going one step at a time. I felt like they needed the guidance to allow them to work together as a class. After watching the video I see that it would have been better to give the students written directions for the activity and just let them work at their own pace.

Mariah's reflection on the video of her teaching (RoA) helped her make connections between using verbal instructions in class and reflective practice: professional growth, meaning that she learned that she needed to improve her instructional strategy. It seemed to me that Mariah interpreted the professional growth as for the students instead of for herself. She could have made connections between the strategies she used in the incidents. She could have made connections between the incident with diverse students, instructional strategies, motivation and management

Mariah experienced schema restructuring of her prior knowledge about her instructional strategy. Instead of giving verbal instructions step by step, she could have given out written handouts (RfA).

> I think that if I had given the students a handout with the directions for the lab, they would have enjoyed the activity even more and could have reflectively thought about the exercise to where they could pinpoint the similarities of what they did.

CIR Form # 5. The incident described in this CIR form happened in Mariah's practicum teaching in Spring 2012. When viewing the video, Mariah noticed that a student, facing in a different point where she was not able to see her face, was making faces, yawning, smiling at her friends and paying no attention to the teaching. Obviously, that student was bored because the information she was presenting with a PowerPoint was not interesting to her.

Mariah explained that she was not paying too much attention to students because she was concentrating on the presentation. Additionally, she was aware that she was being observed (by the members of her peer group). She also iterated the reason for using technology in class:

> I think that it is important to use technology and keep the students interested instead of just standing up in front of the class and lecturing. I wanted to use a combination of words they could visually see and an auditory method of talking about the subject as well as examples to give them an idea of what I was saying.

When reviewing the video, Mariah realized that the presentation was too long and had too many texts and no animations to help draw students' attention. Her reflection on her teaching practice (RoA) helped her realize that she needed to improve the use of technology in class to improve her future teaching (RfA).

> I will try to shorten my presentation time. I will try to make them livelier with jokes or characters to get the students' attention. This presentation was quite

> boring because it only had text on it. Although it lasted less than 10 minutes it seemed to bore the students and I was losing them because of all the wording.

In addition, she also realized that she needed to improve her classroom management strategies. Instead of standing there and read the PowerPoint, she needed to be more mobile and have more eye contact with students to keep them engage.

> I will also move around the room and not stand in one spot. I will have shorter bullet points on the screen that will prompt me to talk about certain things and try not to look at the screen as much as I did here. That will help me to make more eye contact with the students.

Mariah's reflection on the video of her teaching helped her make connections among various elements of teaching and learning: planning for instructions, instructional strategies, including communication and technology and realize what she needed to do in her future teaching (RfA): better use of technology, better classroom management and diverse instructional strategies.

Mariah experienced schema accretion because she added to her existing schema of instructional strategies the specific instances of making the PowerPoint livelier with less text to attract students' attention.

The feedback that Mariah got from one of her peers was that sometimes a teacher should use conversation to engage students when teaching a new topic instead of using technology: "There are instances where facing the students and having an eye to eye conversation and engaging them in a discussion would be better than the use of technology to present a new idea". However, Mariah did not agree on that, which means that her peer's feedback was not able to help her change her existing schemata. Just as she stated,

> They ideas that I have about my critical incident are mostly the same as before the discussion with my peers. I still think that I could have made the presentation

> more thought-provoking and walked around the room more. I totally agree with my peer (name deleted) about technology not always being used as an introductory level. I do think that this incident happened because I was paying too much attention to what I was doing and saying and not as much to what was going on in the classroom.

About learning through collaboration, Mariah confirmed its value because through collaboration novice teachers could learn from each other and help each other grow professionally.

> There are definite benefits to working in a critical friends group. You are able to bounce ideas off one another and gain insight into things that may not have been evident to you before…. However, I do believe that collaborating with your peers is the most important part of career training, and if teachers do not to take the time to discuss their teaching strategies with their peers they may get stuck in the same routine that they develop through time. They could end up becoming obsolete to the students.

Mariah also pointed out the drawback of the collaboration because it could add more stress on novice teachers since they also got a very busy schedule.

> The drawbacks of sharing your teaching in this way would be finding the time to go watch your peers teach. It would help if you were able to record yourself teaching instead of having to plan a visit but finding the time to meet and discuss your teaching is the most difficult part.

She further explained the reason as that "Teachers are already working long hours

Table 14

Mariah's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3) -Schema restructuring (CIR forms: 4)	-Schema accretion (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

planning, grading, attending meetings and career training programs it is near impossible to fit this in as well". Table 14 summarizes Mariah's schema development and VAST.

Summary

To sum up, Mariah focused on various elements related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as learning differences, and learning development. The instructional strategies included classroom management, communications and use of technology. Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to improve in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed her knowledge through schema accretion and restructuring.

The level of knowledge Mariah demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 11, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Mariah was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Patricia

Introduction

Patricia is a White female between the age of 26 and 30. She had no previous teaching experience. She was teaching 4th grade in all subjects. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching, two from the video of her peer teaching in Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below.

Patricia's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred during the first two minutes into the video. In her video-aided reflection, Patricia focused on content knowledge, planning for instructions, instructional strategies, such as classroom management and assessment, learner development, meaningful learning, and learning environment.

CIR Form # 2: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 14 to 17 minutes into the video. In her video-aided reflection, Patricia focused on learner development, learning differences, cultural diversity, and learning environment, including collaborative learning, meaningful learning, and engagement.

CIR Form # 3: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between one to three minutes into the video. In her video-aided

reflection, Patricia focused on planning for instruction, instructional strategies, such as clear communication of instructions, learner development, and learning environment, such as student engagement, collaborative learning, and meaningful learning.

CIR Form # 4: This incident described in her CIR form of the peer teaching in Fall 2011 occurred around seven minutes into the video and the end of the video. In her video-aided reflection, Patricia focused on planning for instructions, learner development, such as learner cognition, instructional strategies, and learning development, such as collaborative learning, and inquiry.

CIR Form # 5: This incident described in her CIR form of the practicum teaching in the Spring of 2012 occurred within the first 15 minutes into the video. In her video-aided reflection, Patricia focused on instructional strategies, such as teacher-student interaction and classroom management, and learning environment.

Patricia's VAST

CIR Form # 1. The video described in this CIR form helped Patricia notice that the beginning of the lesson was not engaging to students because she did not make connections between what students were learning and students' lives. Although she used the Oreos to help students understand the phases of the moon, it did not seem to help. Just as she realized, "I started off just asking questions about the phases of the moon, I didn't engage them, I didn't explore it, and I should have explained last."

Reviewing of the video helped Patricia realize what she did wrong (RoA), and what she needed to do to improve in her future teaching (RfA).

> I did not make learning meaningful at that point in time. I made no connections to their lives, I just jumped in. I introduced scientific jargon before the students had time to explore the phases of the moon in a different way…. I created no

disequilibrium for my students at the beginning of the lesson.

She also elaborated on why it was important to activate students' prior knowledge and what she was going to do in her future teaching; thus, adding to her existing schema the newly acquired knowledge.

> I believe that it is important to activate prior knowledge and engage the students at the beginning of each lesson. In this lesson, I did not do that…. I did not provide my students with the opportunity to show me what they already knew, and I was not able to create disequilibrium. Therefore, I was not able to challenge my students and have them use critical thinking skills during the beginning of the activity.

Patricia's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as content knowledge, application of content knowledge, planning for instructions, instructional strategies, such as classroom management and assessment of prior knowledge, learner development, and learning environment for meaningful learning (*see* Figure 12). The visual stimulus of asking students questions without first evaluating their prior knowledge made Patricia realize that students might not understand the concept they were learning. In addition, the learning was not meaningful and engaging to them if they were not able to make connections to their own experiences. Therefore, she needed to improve her instructional strategies to meet the needs of students and their development.

Patricia experienced schema accretion in her video-aided reflection because she added to her existing knowledge of teaching and learning the new information of taking consideration of students' cognition, such as activation of their prior knowledge as well as creating disequilibrium by challenging to use critical thinking skills.

it was just she and I having a discussion (if without the help of the video).

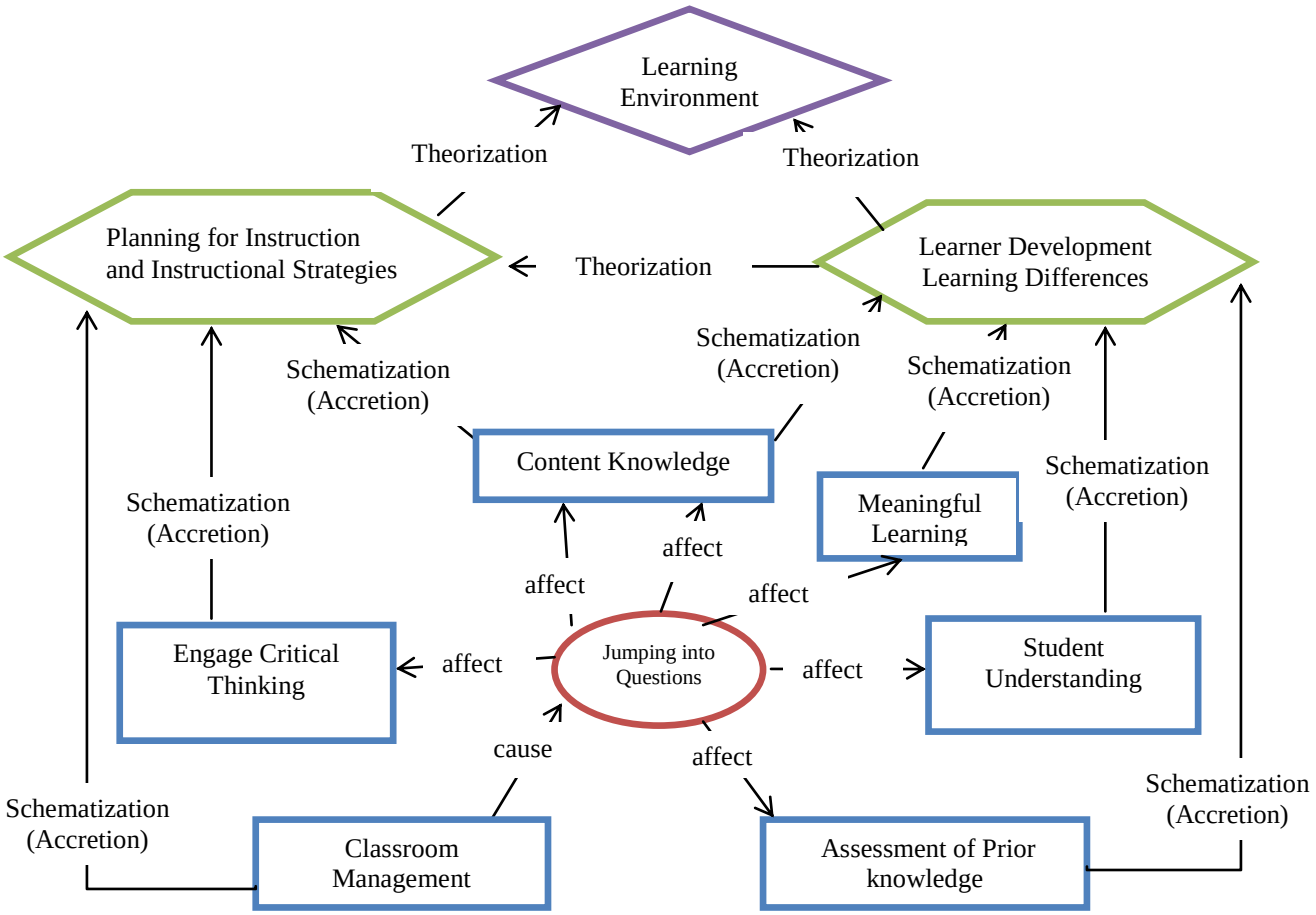

Figure 12. Patricia's Foci of Reflection and VAST Evidenced in the Example CIR

CIR Form # 2. In this incident, Patricia noticed that she was only addressing one student when she was answering her questions instead of getting the whole class involved. She realized that the whole class could have benefitted from it.

> A student asked me a question while she was working on the phases of the moon…. I went to the board and started drawing out the phases of the moon. I was having her help me, but I could have had the entire class help me draw it, not just have a discussion with one student. The whole class probably could have benefitted from doing it on the board together. But, I didn't even realize that

When reviewing the video, Patricia was aware of that "if talking to only one student doesn't making learning meaningful to other students". In addition, she also realized what she did wrong (RoA).

> I should not teach a new concept to just one student on the white board…. I was not able to give students an opportunity to learn and engage with their teacher. I

> should try to focus on the entire class as a whole instead of singling out one person. I wasn't alert or sensitive to other students in the class during this time.

She also elaborated on how she could improve her teaching in the future (RoA):

> I will be more aware of my other students in the classroom. If a student asks a question that I believe will benefit the entire class, or when I start to write on the board, I will ask my students to stop and listen/watch what I am doing. In the future, I will make sure that I teacher the lesson more effectively.

Patricia's reflection on the video of her teaching helped her making connections among the various elements of teaching and learning, such as learner development, planning for instructions, instructional strategies, and learning environment, such as collaborative and meaningful learning, and student engagement. Patricia experienced schema accretion because she added to her existing schema of teaching and learning the new information of addressing the learning of all students in her instructional strategy.

CIR Form # 3. In this incident Patricia and her peer were in the engagement part of the activity and were showing the class a time laps video of the Grand Canyon to help students understand the rock cycle.

> Our goal was for the students to look at the rocks and get them thinking about what has happened over so many years for the Grand Canyon to look like this. We showed the video only one time, and I believe that we should have shown it a second time, and told the students want to look for in the video for the second time around….but there was an awkward feeling why we were showing it for the first time. Right then and there we decided to only show the video once.

Patricia realized from reviewing the video that she should have given clearer instructions to ensure that students understood what they were supposed to do. In addition, she discovered how adjustments in teaching could have impacted student learning.

Patricia's video-aided reflection helped her be aware of what she did not do right (RoA) and what she needed to do to improve in her future teaching (RfA). " I should be

able to reflect and see how my lesson can impact learning. I should have been more clear about what I wanted the students to watch while they were watching the video". She also elaborated on what planning and instructional strategies she would use to engage students.

> I would adjust this to having the students watch it once, then give the students a prompt and have them watch the video again…. I will think about showing short videos twice so that students will be able to comprehend why I am showing the video. I will show the video once without saying anything and just let them enjoy it. The second time the students watch the video, I will have the students write down what I want them to look for while watching the video. After we watch the videos, we will have in-depth discussion and follow that by the explore activity.

Patricia's reflection on the videos of her teaching helped her make connections among the various elements of teaching and learning, such as planning for instructions, instructional strategies, including clear instruction, student engagement, and a learning to encourage collaborative learning and meaningful learning. Patricia experienced schema tuning because she added to her existing schema of teaching and learning the new information that is to adjust lesson planning and instructional strategies to create a fun and meaningful learning environment. Just as she wrote, "if the students were able to view the video one more time and have a prompt, I feel they would have been able to make more connections with what they were watching".

CIR Form # 4. In this incident, Patricia noticed that two activities in her lesson plan were ordered in a way that did not help students understand the subject that they were learning (RoA).

> In our lesson plans, we planned on showing a slide show about the steps of the rock cycle and show what happened in each part of the cycle. After that we were going to do the explore activity with the crayon shavings. I believe that we should have done the crayon activity first, and then introduce the topic of the rock cycle. This way, students can visualize what is happening in the rock cycle, with their experience from the crayon activity.

Her reflection made her aware that she should have flipped the activities because flipping the activities could allow students to do exploration and create disequilibrium before introducing science terms (RfA). After the class, she spoke with her peer about how she though they should flip the activities next time for their lesson.

Patricia's reflection on the video of her teaching helped her make connections between the various elements of teaching and learning, such as planning for instructions and student development. She experienced schema accretion by adding to her existing schema the new information of switching the order of the activities to ensure students' understanding.

CIR Form # 5. In this incident, Patricia noticed that she was not moving around in the class. Instead, she stood behind the desk in the front for a long time. She also pointed it out that she "only experienced the incident once I watched the video" and did not walk around and interact with student.

> During the first videotaped lesson, I noticed that I stood behind the desk almost the entire class. I didn't think about it until I watched myself on the video, but I was definitely standing behind it for almost the entire lesson.

Patricia realized when reviewing the video what she did not do right (RoA) and what she needed to do to improve (RfA).

> This incident directs me to be aware of my surroundings and to make conscious efforts to be "one" with my students and not just stand up at the front of the classroom
> I made an effort to move around the classroom more the next lessons and beyond. I can make sure that I include something in my notes during teaching to walk around the class and make sure that my students feel equal with me.

Patricia's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as instructional strategies, including teacher-student interaction and classroom management, and learning environment.

Patricia experienced schema tuning and schema accretion. One the one hand, her schema had to change because she had not believed that she could stand behind the desk all the time if she had not seen herself doing that in the video. She had to fine tune her schema about herself and incorporate the new information that she did do that. Then, she made conscious effort to change it. On the other hand, she expanded her existing schema by adding more information into it, such as walking around, and interacting with students to make them feel supported in their learning. Patricia mentioned that the members of her Critical Friends Group and her supervisor had helped her make a conscioius effort of what she needed to do in the class.

> I decided that I would make a conscious effort to walk around the classroom more while I am teaching. My group members suggested that I just make a conscious effort to move around more and to be aware of my surroundings. My supervisor and one of the group members noticed in the videos and class that I did move around more after I realized what I wasn't doing.

But Patricia also pointed out that although collaboration did not bring her new ideas about her teaching, but she agreed that it had benefits and drawbacks.

> I don't necessarily have any new ideas about my critical incident video, but I do believe that the more teachers share and reflect, the better people and teachers we become. Some drawbacks that could occur from collaborating are that the teachers may not agree with or get along with another teacher. But, with me being a professional, I would respect the other teacher's opinions and keep in mind what they say or recommend to me, especially since they probably have a lot more experience with me.

Table 15 summarizes Patricia's schema development and VAST.

Table 15

Patricia's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 4) -Schema tuning (CIR form: 3)	-Schema accretion and tuning (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

Summary

To sum up, Patricia focused on various elements related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions, instructional strategies, learner development, learning learner development and learning environment. Her video-aided reflection on her teaching practices (RoA) helped her realize what to improve in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed her knowledge through schema accretion and tuning.

The level of knowledge Patricia demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of

her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 12, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Patricia was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Sheryl

Introduction

Sheryl is an African American female between the age of 22 and 25. She had no previous teaching experience. The subject she was teaching was social science. The data collected from her included three CIR forms: one from the video of her practicum teaching, one from the video of her peer teaching in Fall 2011 and one from the video of her teaching in Spring 2012. These CIR forms are presented in the chronological order below. Sheryl participated in the interview as well.

Sheryl's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 15 to 20 minutes into the video. In her video-aided reflection, Sheryl focused on learner development, instructional strategies, such as classroom management and communication, and learning environment.

CIR Form # 2: This incident described in her CIR form of the peer teaching in the Fall 2011 occurred between six to nine minutes into the video. In her video-aided

reflection, Sheryl focused on instructional strategies, including communication and student engagement.

CIR Form # 3: This incident described in her CIR form of the practicum teaching in Spring 2012. There was no time frame recorded in the CIR form. In her video-aided refection, Sheryl focused on instructional strategies, including student engagement, use of technology, and classroom management, and learning environment.

Sheryl's VAST

CIR Form # 1. The video described in Sheryl's CIR form #1 was about her practicum teaching experience. The video helped Sheryl notice what she could not have noticed without the help of the video in her reflection (RoA).

> As I was watching my lesson over again, I noticed the group that was closest to the door. In this group were three girls and one boy.…I also noticed that this group was talkative and might be tempted to get off task and stop working so I gave them another passage to read and discuss about. As soon as I gave this group the topic. I turned around and began talking to attend another group.…That group immediately began talking about things that were unrelated to their passage.

She also noticed that group of students finished their activity: drawing a pictorial, but was not able to explain through words one of the causes of the European exploration and colonization. Therefore, she should have given more challenging tasks to that group and spent more time with them to prevent them from getting off track (RfA).

> I felt that I should have given this group more challenging instructions to keep them engaged and working.…and spend more time working with these students and trying to engage them in this lesson and their group task.

Sheryl believed that a teacher should have been aware of students' knowledge and how they learn, and more sensitive and responsive of student's knowledge and the learning environment.

> I feel that… as a teacher I should have been more alert and responsive…I did not fully understand how the factors in the classroom environment affected these students' learning …. I feel that I should have showed better understanding of how learning occurs in my students.

However, she saw from the video what she was doing did not comply with what she believed because she did not give that group of students enough support and challenges they needed. Therefore, Sheryl went through schema accretion that she needed to be more responsive and attentive to students' needs: spending more time with them and asking more thought-provoking questions to motivate students and keep them engaged.

> The main belief I have, is that as an educator I should be providing each student with the same attention, respect, and worth. I believe that it is extremely important for teachers to pay attention to all of their students and do their best to help each and every student succeed.

In addition, she realized that she should have better communicated her expectations of students to challenge them.

> I do feel thought that my expectations for students were not high enough…. I feel that I was not able to challenge students enough at times so that they did not have time to get off task.

Sheryl's schema of learning environment consisted of classroom management and how it could affect student learning. In terms of classroom management, Sheryl was able to see how the learning environment was affected if some students became distracting to other students in the class. "This can be very distracting for a class if others are playing and off task, and I should have seen this happening and done something about it". She was also aware of something she needed to add into her schema, that is, how she should communicate her expectations and keep students engaged.

> I do feel thought that my expectations for students were not high enough at times during this lesson. I feel that I was not able to challenge students enough at times so that they did not have time to get off task. I feel that this lesson went ok, but I could be a more culturally relevant teacher if I work harder to challenge students

in a way that creates an even better learning environment than in this lesson.

She also realized that she should have communicated with students in a way that could ensure the positive relation between her and her students.

> [What] I will do differently in the future is to make sure that I talk to students in a respectable way. Though getting frustrated when seeing students doing unrelated school things students and playing during an activity does not gave no adult talk to a child in a disrespectful manner

Sheryl's reflection on the video of her teaching helped her make connection among various elements of teaching and learning, such as learner development and learning differences, as well as instructional strategies, including classroom management and communications, and learning environment (*see* Figure 13). The visual stimulus that

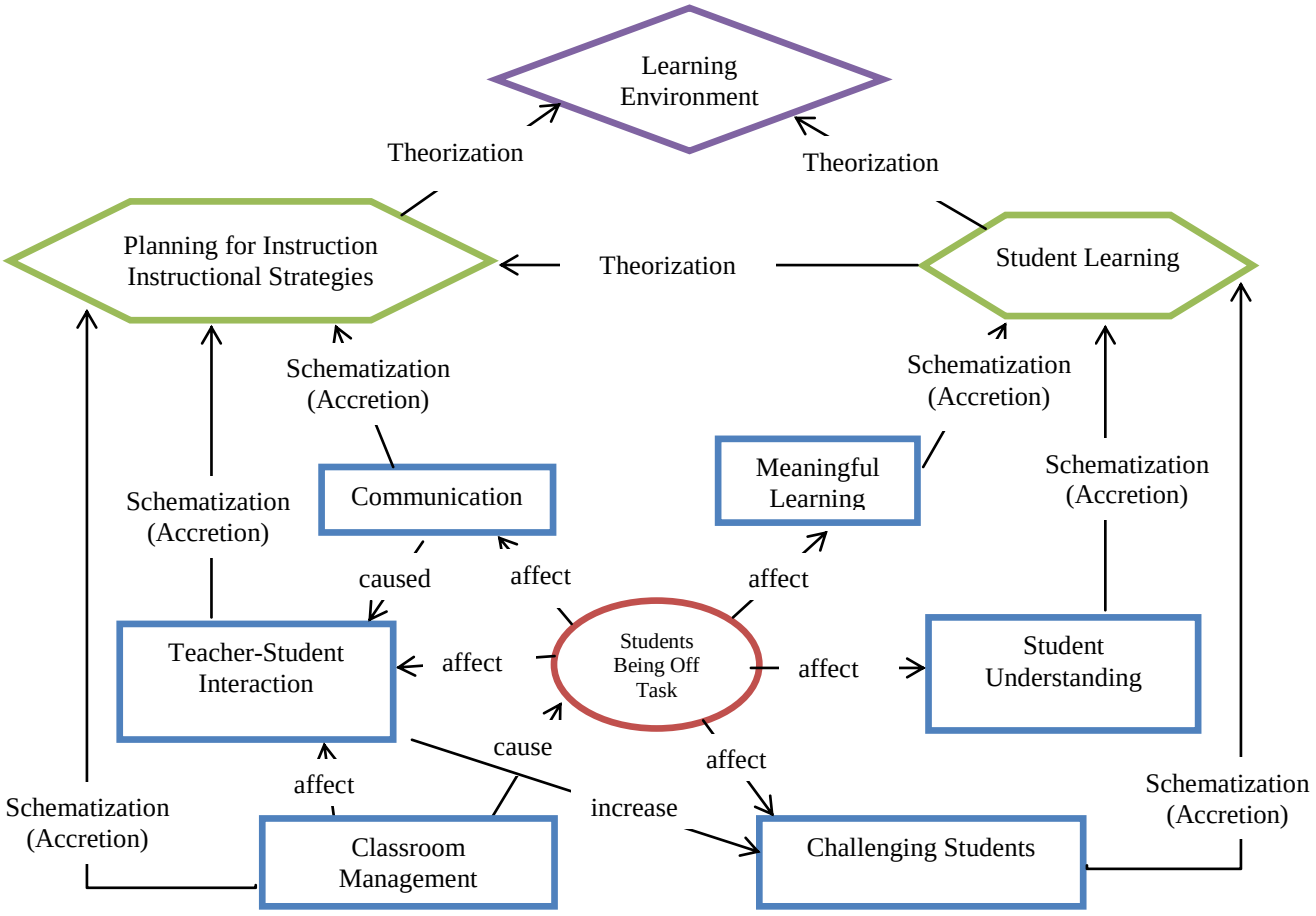

Figure 13. Sheryl's Foci of Reflection and VAST Evidenced in the Example CIR

Students were off task made Sheryl realize that she needed to improve her instructional strategies to better communicate and interact with students, to challenge them, and create a meaningful learning environment so that every student could understand what they were learning. She experienced schema accretion because she added to her existing schema the new information that she needed to engage students and create a better learning environment with better communication, classroom management, and responsiveness to students' needs.

CIR Form # 2. The incident described in this CIR form happened in Sheryl's peer teaching in Fall 2011. In this incident, Sheryl used language in her teaching that she was not supposed to use: "My handwriting sucks". By watching the video, she realized that she used inappropriate language when giving directions.

> I forgot that I was imaging teaching middle level students. It was bad language to use in front of a middle level students instead I should have used appropriate grammar when showing or given students directions to an activity.

She also noticed that one of the students seemed a little disengaged. "I almost forgot he was there. I should have paid more attention to each person in the class".

Sheryl's reflection on the video of her teaching (RoA) made her "wonder what I could have done better to have my lesson more exciting" (RfA). Sheryl interpreted that the student was not interested because she did not understand the knowledge the student needed and did not pay enough attention to him. She believed that "it is important for teachers to pay attention to all students and do their very best to help each and every student succeed." With the help of the video, she realized that "I did not give one of the students "the engagement they needed to be more active in the activity".

Sheryl made connections from the student's disengagement with her teaching and classroom management strategies. She realized that she needed to pay more attention to students than complete the lesson. "I was more concerned with completing the lesson rather than been more involved with the student". Moreover, she wanted to keep growing so that she could be able to "transition from one step to the next. Even though I did a good job it didn't feel natural. I want it to come to me so it doesn't feel rehearse".

Sheryl's reflections on his teaching experience helped her make connections among the various elements of teaching and learning, such as teaching strategies, including communications and student engagement. She experienced schema accretion because she added to her existing schema the new information or the specific instructional strategies she needed to implement in her future teaching, which is being more involved with students. Although Sheryl realized what she needed to improve her teaching practice and was able to identify what needed improvement, she seemed to have difficulty reaching a specific solution about what she planned to do and how she would do it in her future teaching practice.

CIR Form # 3. The incident described in this CIR form happened in Sheryl's practicum teaching in Spring 2012. When reviewing the video, Sheryl was able to identify that she was not mobilizing around the classroom (RoA).

> I saw in the video was the lack of mobility I used during the lesson. Instead of walking around during the video, I stayed in place at the front of the classroom because I had to click the mouse each time I needed to change the power point slide.

What also caught her attention was that she noticed grammatical errors while she was delivering information.

> I was annoyed about is delivering information while making grammatical errors. This is something that I have struggled with since I started student teaching. Something that I could have considered doing here is taking my time to think before I speak.

The visual stimuli in the video made Sheryl realize that students sitting at the back of the class could have become off task and her immobility prevented her from fixing the problem quickly:

> As I look back at my teaching I was bothered and agitated by the fact that I wasn't in a central location which disabled me in providing extensive instruction to students in the rear of the classroom. This malfunction in my actions was dissatisfying to me because it could have hindered me from quickly dealing with off task students.

She realized that her immobility could have been disadvantageous to those students who were sitting at the back of the classroom. "I should have been mobile, moving around the room in order to continuously keep the students engaged as well as taking the time pronouncing words." (RfA).

Sheryl's reflection on the video of her teaching helped her make connections among various elements of teaching and learning, such as instructional strategies, including use of technology and classroom management to engage students in their learning.

> This incident shows that I value using technology in the classrooms. By incorporating technology into this lesson, students were more engaged and excited about the human body….Thus, one of the main benefits of using technology for classrooms is that unlike a teacher-led classroom, where students passively receive whatever information the teacher is providing, in tech savvy classrooms, students are active participants.

Unlike in her CIR forms in Fall 2011, Sheryl was better able to find a solution to the problems she identified in her CIR form in Spring 2012, an evidence of her improvement on VAST:

> This incident directs me to use a portal clicker throughout my presentation on a smart board. This way I am to move around the classroom and engage each student in the lesson. I want students to see that I notice everyone, not just half of them.

Sheryl experienced schema accretion because she added into her existing schema the new information of proper instructional strategies that could help create a learning environment where every student was supported and engaged.

> Something's that I could have considered doing here would include using a portal clicker, or using a student helper. Using a student helper(s) engages the students giving them more involvement in the lesson.

Sheryl pointed out that her peers in her group helped her realize what problems her immobility could cause and the other peer suggested using a portal clicker as a solution, which might have explained why Sheryl's CIR form improved.

> One of the members of the group noted that since I did not move around the classroom, she feels as though students in the back were not engaged as those in the front and they are easily to get off task….The other member suggested that a portal clicker would have worked. The portal clicker allows me to move throughout the classroom and be able to have access to the promethean board.

Sheryl benefited greatly through collaboration with her peers. In addition to giving each other advices and feedback, collaboration provided each member the opportunity to learn from each other and support each other.

> Learning through collaboration with the members in my group, was great. The both had great advice on how to correct the incident. Collaborating with the group was an empowering benefit because it helped me and the other members achieve my goals in an easier and more efficient way, and enhances quality.

What seemed to be especially valuable was the support Sheryl got from the members of her Critical Friends Group as their feedback helped her re-evaluate her performance in the class and realize that she was not doing as bad as she thought.

> I also learned that I was being too hard on myself, and my group members help me realize that no one is perfect, but with practice and commitment I can come close to it. Therefore, we came up with great ideas to help one another correct the incident in a creative way.

She also pointed out that commitment and appropriate communication were critical in making this collaboration to be valuable.

> Since each member is aware of the importance of this assignment to give great feedback, the level of commitment and efficiency enhanced, and so did productivity and efficiency. At the end of both sessions, I observed that when my group members and I work together we learn from one another and extend our interaction and learning outside of classroom.

Sheryl's reflections on her teaching experience helped her better understand the connections among the different elements in her teaching, such as student engagement, her instructional strategies, use of technology, classroom management and student learning. She experienced schema accretion by adding to her existing schema new information, that is, using technology in a creative and appropriate way in order to help all students, such as using a portal clicker or a student helper. Moreover, Sheryl stressed that it was very helpful to have peers giving her advice and feedback on what needed to improve and how to improve because the group members could learn from as well as support each other. Table 16 summarizes Sheryl's schema development and VAST.

Table 16

Sheryl's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2)	-Schema accretion (CIR form: 3)
VAST	-Schematization -Theorization	-Schematization -Theorization

Summary

To sum up, Sheryl focused on various elements related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions, instructional strategies, and learning environment. The instructional strategies included different elements, such as classroom management and communications in order to create a learning environment that encourage learning. Her video-aided reflection on her teaching practices (RoA) helped her realize what needed to improve in her teaching and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and learning, thus expanding her prior knowledge about teaching and learning. She constructed her knowledge through schema accretion.

The level of knowledge Sheryl demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 13, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Sheryl was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Ted

Introduction

Ted is a White male between the age of 26 and 30. He had no previous teaching experience. The subject he was teaching was science. The data collected from him included four CIR forms: two in Fall 2011 and two in Spring 2012. The four CIR forms described four critical incidents: two from the video of his practicum teaching and two from the video of his peer teaching in Fall 2011. These CIR forms are presented in the chronological order below. Ted was not able to complete the CIR form in Spring 2012 because his participating school did not give him permission to video record his teaching in the school.

Ted's Foci of Reflection

CIR Form # 1: This incident described in the CIR form of his practicum teaching in Fall 2011 occurred between two to three and eight to nine minutes into the video. In his video-aided reflection, Ted focused on content knowledge, learner development, instructional strategies, such as classroom management and assessment, and learning environment.

CIR Form # 2: This incident described in his CIR form of his practicum teaching in Fall 2011 occurred throughout the lesson, but noticeable at around six minutes, nine to 13 minutes, and 19 to 21 minutes. In his video-aided reflection, Ted focused on planning for instructions, learner differences, and instructional strategies, such as classroom management, and learning environment to engage students in learning.

CIR Form # 3: This incident described in his CIR form of his peer teaching in Fall 2011 occurred between 11 to 17 minutes. In his video-aided reflection, Ted focused on learner development, planning for instructions, instructional strategies, such as management, and learning environment to motivate students in learning.

CIR Form # 4: This incident described in his CIR form of his peer teaching in Fall 2011 occurred between four and five, and between 14 to 17 minutes. In his video-aided reflection, Ted focused on planning for instructions, instructional strategies, such as communication and technology, classroom management, learning environment, and professional learning: reflective practices.

Ted's VAST

CIR Form # 1. The video described in Ted's CIR form #1 was about his practicum teaching experience. The video helped Ted notice that he did not provide students the explanation and correct answer when they did not answer them correctly.

> As I watched and identified this incident during my instruction, I thought I disregarded students' response to the essential questions and formative assessment. I was continuously checking for students understanding of instruction, but when the answer was incorrect I just blow the response off, instead of telling them it's wrong.

Ted realized that it was disrespectful to students because he did not show respect to their ideas and input about content and input: "I thought I disregarded students' response of the essential questions and formative assessment". This existing knowledge he held came from "numerous amounts of material on the importance of respecting students". Instead of appreciating students' participation in class, he was "blowing them off", which "could have made these students not feel valued…and possibly not contribute to the following class discussion".

In addition, he realized that he was not taking advantage of the opportunity for students to learn due to time management and inappropriate instructional method. “I failed my students by not providing the education they deserve through learning opportunities encompassed in their experiences in the classroom….The pressure of time reflects my time management”.

When reviewing the video, Ted realized that he did not provide feedback and explain why the students’ answer was not correct and it was necessary to correct students’ wrong belief. Instead, he simply moved on to the next student when someone answered incorrectly. “Though this lesson allowed inquiry, I neglect to honor student’s responses and guiding them to the correct answers”. His reflection on his teaching experience (RoA) informed him of what he needed to do in his future teaching (RfA).

> I should have used better pedagogy related to the content and student development....respect the student’s response and provide a better opportunity for learning to occur through these incorrect responses. I could have used a better method in assessing the students understanding of content matter, which would support the learning opportunities to make the subject matter meaningful.

Ted also considered his not providing feedback to students’ incorrect answer as something that contradicted his personal belief that “each student should be treated equally and respected.

As described above, Ted’s reflection on the video of his teaching helped him make rich connections between the various elements of teaching and learning, such as instructional strategies, including time management and assessment, and learning environment (*see* Figure 14). Ted experienced schema accretion because he added to his existing schema the new information of implementing more effective instructional and classroom management, communication strategies in order to engage every student in

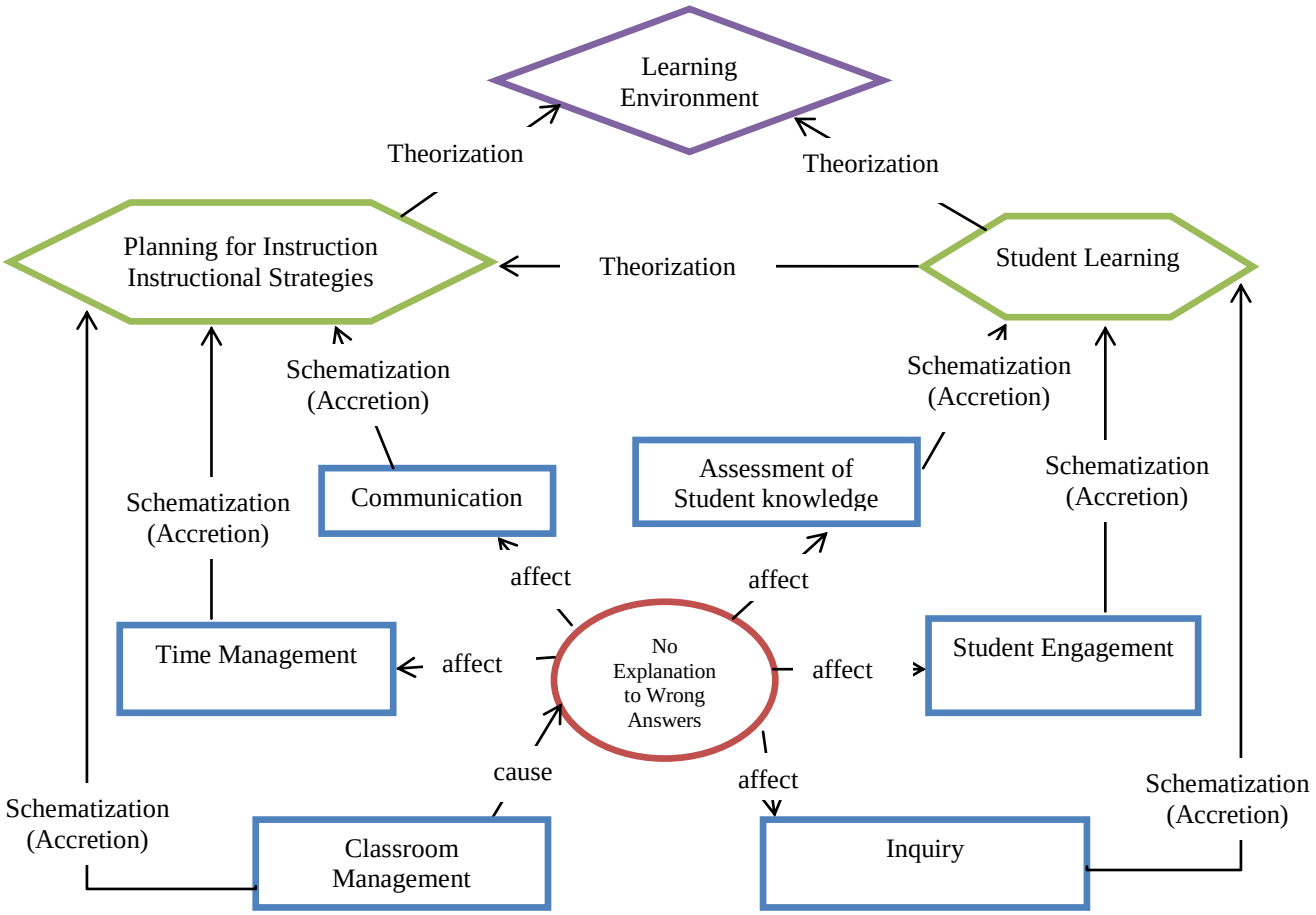

Figure 14. Ted's Foci of Reflection and VAST Evidenced in the Example CIR

learning and to create a more supportive learning environment.

CIR Form # 2. The incident described in this CIR form also happened in Ted's practicum teaching in Fall 2011. In this incident, Ted saw that one of the students was disengaged during the lesson when he was using the popcorn method that he had learned from his mentor teacher. He realized that he "should have had a better instructional method that was more engaging and incorporated differentiation". He felt that he failed to maintain students' participation and engagement. He watched in the video that as he was probing for students' prior knowledge at the beginning, the student enjoyed completing the concept map and working in groups. But once the introduction was over, the student lost interest in the popcorn reading because it did not help him obtain new information

related to the subject matter. He explained why he chose to use the popcorn reading as an instructional method: "I opt to use this instructional method, popcorn, because I observed the mentor teacher use it for previous lessons. I believed students would have followed along with the text as it was read and even ask questions". He also realized that he needed to mobilize more in the class to keep everyone on task and engaged.

> I could have maintained student engagement by being more mobile in the class…I didn't notice the young man being disengaged as I was on the other side of the class and his back was to me….I did observe that I directed student' to the right page and redirected them on task, but that was on the students near me.

But when he noticed the popcorn reading method could not keep the student interested and engaged, he wondered "there should have been better instructional and classroom management". He also realized that he did not differentiate instruction at all for his high achievers in class, so they were bored.

The stimulus in the video made Ted wonder what he did not do in his planning and implementation of teaching (RoA) and what he could have done differently in order to keep every student in the class engaged (RfA).

> I didn't develop a lesson that was engaging enough for the diverse learners in my class. I should have applied content pedagogical tactics into planning my instruction. Students enter the class with an amount of prior knowledge, whether minimal or substantial the instruction has to be tailored to grab and hold the interest of all students. While planning this lesson, I could have had pre-assessed students to help create an engaging lesson. Differentiation would have solved this problem.

Ted made connections from a student's disengagement with his lesson planning, classroom management, learner difference, and teaching strategies. He realized that he needed to have a lesson plan that could be tailored to the prior knowledge of different students in order to keep them engaged. In addition, he needed to mobilize more in the

class to keep students on task and give them directions when needed. Moreover, he needed to use a variety of teaching strategies to support the learning of every student.

Ted valued student engagement and wanted to motivate every student to learn despite their differences of their prior knowledge and wanted to give every student the respect and support they deserved. “Rooted in my teaching philosophy is that each student should be treated equally and respected”. When reviewing the video, Ted realized that he was not providing every student the learning opportunity because he did not explain why his/her answer was wrong. He could have used more effective instructional strategies to keep him/her motivated.

> I failed my students by not providing them the education they deserve through learning opportunities encompassed in their experiences in the classroom. I didn’t provide an engaging lesson, supported in differentiation instruction to support the various levels of student knowledge. It is critical for each student to participate in the lesson even if they already know the material. Students that have mastered the material can be used to help their peers. As an educator I believe that it is crucial to have effective instructional methods.

Ted’s reflection on this teaching experience (RoA) helped him realize that he needed to be more responsive to students to address learning differences (RfA).

> Even though this challenge [providing essential questions and probing for further/deeper meaning of concepts] was provided, but for tome students it wasn’t. I should have offered multiple instructional methods to support the diversity of learners in the class. I feel that the lesson had culture relevance but not enough to create the desired learning environment of culturally responsive pedagogy.

Ted’s reflections on the video of his teaching helped him make connections among the various elements of teaching and learning, such as planning for instruction, instructional strategies, and instructional strategies to engage a diversity of learners. He experienced schema accretion because he added to his existing schema the new information that he needed to implement more effective instructional strategies and create

a learning supportive and culturally relevant environment to engage every student in learning.

CIR Form # 3. The incident described in this CIR form happened in Ted's peer teaching in Fall 2011. When reviewing the video, Ted realized that he was not mobilizing around the classroom once the introduction session ended:

> During the beginning of the lesson I was maneuvering through the class, but once the students' engagement/introduction session ended, I became stationary. What movement I did have was between the lab-table where my materials were to the computer, which is near the White board.

Ted's reflection on the video of his teaching made him realize that students could have become off task due to the lack of his presence in the class (RoA).

> The lesson became much more teacher-centered focus, instead of a student lead-discussion and inquiry….Student could easily get off task and maintain off task, because I was not making my presents[sic] known throughout the class. Why didn't I continue to move throughout the class while facilitating the lesson….If I have done that my presents [sic] would have been felt, students could have increased their participation.

He further elaborated on what he needed to improve (RfA). In addition, he realized that his being stationary could have been disadvantageous to those students who were too shy to speak out and ask questions because he was not able to see who might have a question. Just as Ted described from the perspective of the students,

> Mr. Ted stood at the table with his minerals. It was too hard for me to see to the minerals he was holding up, because I was in the back of the class. I had a few questions related to how to classify minerals, but because I am shy I didn't ask. If Mr. Ted would have continued to move throughout the lesson I would have asked him personal when he came near my work station.

When reviewing the video, Ted was able to make rich connections between his immobility in the class and student motivation and management, student development and lesson planning, and instructional strategy and learning environment.

> I should have been more mobile through the lesson to manage student motivation in learning the material. I would have limited a student's growth in the content by not being fusible for them to ask questions or check their understanding. Students learning opportunities were limited as I didn't provide instruction opportunities to individual support learning. When I created this lesson, I didn't think about having to personal identify and display the minerals, which created an instructional modification that result in non-mobility.

Ted's reflection on his teaching experience made him be aware of what he needed to improve and how he could make the improvement in his future teaching (RfA): "I will apply these standards into my lesson planning and instructional methods to ensure that students have a learning environment that supports responsive learning". He believed that it was important to assess students' knowledge and engage them to learn through the method of inquiry and explained why. The realization of his immobility in the class triggered disequilibrium, which made him question whether what he thought he did in classroom really support his beliefs.

> During my critical incident, I failed my students by not providing the adequate amount of support to develop their learning. I felt I am a mobile teacher, making my presents [sic] know to students, and to support their learning but after this incident I am question how mobile I am in the classroom.

He also believed that every student should be treated equally and respected. While watching the video, he became concerned that "students left the class with questions, which I didn't answer".

Ted experienced schema tuning and accretion in his video-aided reflection. He adjusted his existing schema that he considered himself to be a mobile person and added into his existing schema the new information, or specific instances of the instructional strategies that could help create a supportive learning environment where every student has the opportunity to learn:

> When I shifted the instruction to discussion/lecture….I lost sight of students' individuality as I became a stationary educator. I became less assessable to help support, and foster student learning. Even though I feel that the lesson was a success, I can always improve my cultural relevance and foster a rich learning environment.

The new information Ted added to his existing schema was "to make a conscious effort to ensure that my presents [sic] is known throughout the class…, which would have possible increased student comprehension", which was also the action that Ted was going to take in his future teaching.

Ted's reflections on the video of his teaching helped him make connections among the various elements of teaching and learning, such as planning for instructions, learner development, learning differences, instructional strategies, and learning environment. As mentioned above, he experienced schema tuning and schema accretion by adjusting and adding to his existing schema the new information of implementing more effective instructional strategies in order to engage every student in learning and to create a more supportive and culturally relevant learning environment, such as being more mobile in class to ensure that no students left the class with their question unanswered.

CIR Form # 4. The incident described in this CIR form happened in Ted's peer teaching in Fall 2011. In his video-aided reflection, Ted described what he did in class was "negligence" because he was not facing the students when he was talking and writing on the White board, thus, he had no idea about what was going on in the class.

> During instruction, I went to the White board to transcribe the Mohs hardness scale and everyday items that equal the hardness of minerals. While writing this information on the White board, I had my back to my class. When my back was turned, I had no idea what my students were doing. I also was explaining the material while writing, which means I was talking to the board.

As can been seen from what has been described above, the visual stimulus of the video made Ted remember what he had learned in the education preparation program that stressed the importance of knowing what is going on in class (RoA).

> I failed to know what my students were doing at all times, even though they should have been actively participating in the lesson. What strikes me most about this incident is that throughout my education preparation courses, it has been stress to always know what is happening in your class.

He further elaborated that he even told himself not to turn his back on the class, especially when writing on the board. He felt disappointed at himself as he said: "I didn't notice the incident while instructing my peers and make corrections". He also realized turning back on students could have caused his students to be unable to keep up with the instruction, which is especially true when the students were hesitant and unwilling to ask question in public. Ted's intention to use the White board was to help students learn. What he did, however, did not help student with their learning. Instead, it might have adversely affected their learning since he had his back towards them.

> The board was a way to reach multiple learning styles and provide an easy, quick guide to the Mohs hardness scale. I believed that allowing students to state general everyday items that are equivalent to the hardness scale would provide ownership of the material and improve students' comprehension. In order for this to be done I had to use the White board, which resulted in my turning my back to the class.

With the help of the video in his reflection, Ted was able to connect his turning back to communication and technology, lesson planning, classroom management skills, instructional strategies, student learning and reflective practice: professional growth.

> I should have created better planning and incorporated communicating the information with students through the use of media. This would have improved the inquiry of the content, and fostered a safer classroom environment.

Ted's video-aided reflection on his teaching experience made him be aware of what he needed to improve (RoA) and how he could make the improvement in his future teaching (RfA).

> I knew I was going to use the white board, so I should have written the information on the board prior to class. Instead, I wrote the material throughout the lesson and provide a change for a negligence claim to be made and help against me.

He was able to come up with a solution to improve his classroom management skills that were related to lesson planning and instructional tactics, which was to write the content on the White board before class so that students could use the content on the White board and meanwhile he was able to monitor what students were doing and give them the attention they needed.

> During my critical incident, I failed my students by not providing supervision and talking to the board, with my back to them….It is critical for each student to be able to hear the lesson and receive attention….During this incident, if a student had a question it would have been nearly three minutes before acknowledged it.

Ted experienced schema tuning and schema accretion caused by his use of the White board and his inability to keep supervision of the class. Ted was able to get a solution by accommodate his schema about how to use this technology, which is writing the content on the white board prior to the class, which was an addition to Ted's existing schema, thus, causing his schema accretion. He elaborated how he was to improve his future teaching,

> Although I was able to see and recognize my mistake in the classroom as the teacher can grow through this incident. In the future, I will remember this incident…to maintain supervision of my students at all times.

Ted's reflections on the video of his teaching helped him make connections among the various elements of teaching and learning, such as planning for instruction,

Table 17

Ted's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4) -Schema tuning (CIR form: 3,4)	N/A
VAST	-Schematization -Theorization	N/A

instructional strategies, including communication and technology, classroom management, learning environment, and professional learning: professional growth. He experienced schema tuning and schema accretion, which is having a better lesson plan, instructional tactics, and classroom management strategy to create a better learning environment for students. Table 17 summarizes Ted's schema development and VAST.

Summary

To sum up, Ted focused on various elements related to teaching and learning when reviewing videos of his teaching and reflecting on his teaching experiences captured in the video, such as planning for instructions, instructional strategies, learner development, learning differences, learning environment, and professional learning. His video-aided reflection on his teaching practices (RoA) helped him realize what needed to improve in his teaching and how to improve it (RfA). He made connections among the different elements that were related to teaching and learning, thus expanding his prior knowledge about teaching and learning. He constructed his knowledge through schema tuning and accretion and tuning.

The level of knowledge Ted demonstrated in his CIR forms is mostly information with some characteristics of theory because his knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning he showed is intermediate or schema toward terminal to theory because most of his information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 14, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, he experienced schematization and theorization in her video-aided reflection. Ted was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment.

Teresa

Introduction

Teresa is a White female between the age of 41 and 50. She had no previous teaching experience. She was teaching 7th grade life science when the data was collected. The data collected from her included five CIR forms: four in Fall 2011 and one in Spring 2012. The five CIR forms described five critical incidents: two from the video of her practicum teaching and two from the video of her peer teaching Fall 2011, and one from the video of her practicum teaching in Spring 2012. These CIR forms are presented in the chronological order below. In addition, Teresa also participated in the interview.

Teresa's Foci of Reflection

CIR Form # 1: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between 15 to18 minutes into the video. In her video-aided reflection, Teresa focused on learner development, learning differences, instructional strategies, such as communication and technology, and learning environment.

CIR Form # 2: This incident described in her CIR form of the practicum teaching in Fall 2011 occurred between one to four minutes into the video. In her video-aided reflection, Teresa focused on planning for instructions and student learning.

CIR Form # 3: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between three to five minutes into the video. In her video-aided reflection, Teresa focused on learner development, planning for instructions, and learning environment.

CIR Form # 4: This incident described in her CIR form of the peer teaching in Fall 2011 occurred between six to seven minutes into the video. In her video-aided reflection, Teresa focused on instructional strategies, such as classroom engagement, communication, teacher-student interaction, and learning environment.

CIR Form # 5: This incident described in her CIR form of the practicum teaching in Spring 2012 occurred between one to five minutes into the video. In her video-aided reflection, Teresa focused on learner development, instructional strategies, such as time management and classroom management, and learning environment and student engagement.

Teresa's VAST

CIR Form # 1. In this video described in her CIR form #1 Teresa was drawing her family pedigree and did not notice that the illustration she was drawing ran off the side of the screen and students could not see the entire drawing. None of the students told her that they were not able to see the entire drawing.

> I felt that as a teacher and leader of the lesson I should have a better awareness of all of my surroundings. Instead I felt as though I was almost too focused on covering the material and forgot to check myself as I went along in the lesson… it is my responsibility to self-correct issues like this and be aware at all times how my instruction is being received.

The benefits of using technology in the class as well as how communication and technology could affect students if it was not properly used: "if my communication techniques are not sound and consistent the students will not receive effective instruction during my instruction". She also realized that there were moments she was not paying attention to the language she used.

Teresa's video-aided reflection helped her realize what she needed to improve (RoA) and how to make the improvements in her future teaching (RfA). As she reiterated,

> I was able to allow students the opportunity to engage, inquire, and learn during my instruction. I introduced a new topic that called upon their prior knowledge during the lesson. Students were engaged to translate their families into a pedigree even though not all students fit into what a "normal" family pedigree would be.

She was aware that her choice of language made students feel they were equal to everybody else regardless of their socioeconomic status and their family background.

> A majority of my students in this class come from one parent households or broken families for numerous reasons. When any student walks through the doors of the school they are all equal and should be treated as such. It does not matter

> their socioeconomic situation, family structure, or anything else. They all deserve the most engaging and non-bias education that as a teacher I can provide.

Her video-aided reflection on her teaching experience (RoA) helped her find out what she could do to improve (RfA). She explained that she had to ensure that how the content was being communicated was clear and accessible by all students no matter where they were in the classroom. She could not just focus on getting through the lesson. What really mattered was students' understanding and what they were learning was meaningful to them.

> Even if I succeed in getting through the lesson, if the students missed part of the lesson because I was not aware of what was happening on the board behind me then it does not matter if I finish or not. The students will not understand and be able to relate the information to real life situations.

As described above, Teresa's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as learner development, instructional strategies, including communication and technology, learning environment, and cultural and ethical issues (*see* Figure 15). The visual stimulus that students were not able to see her drawing helped Teresa realize that every student deserved the right and opportunity to learn and not being able to see the drawing could have affected their understanding. In addition, she realized that she needed to improve her instructional planning and strategies, such as use of technology and time management. Teresa experienced schema accretion in her video-aided reflection because she added to her existing schema the new information that every student should have equal rights to learn and deserve respect despite their socioeconomic, cultural and family difference and that the end goal of teaching was not getting through the lesson; it was to ensure students understood what they were learning and were able to link it to real life.

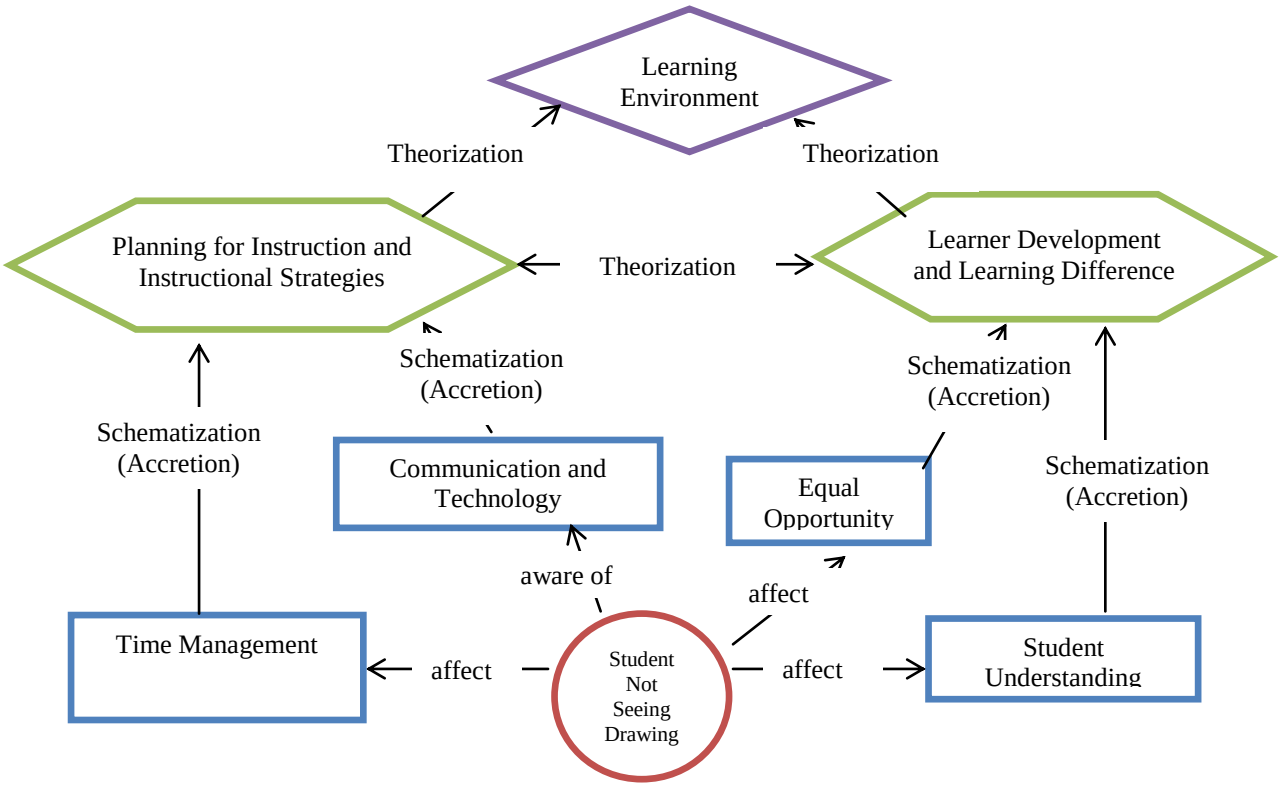

Figure 15. Teresa's Foci of Reflection and VAST Evidenced in the Example CIR

CIR Form # 2. In this incident, Teresa noticed from the video that she had a typo in the overhead. She felt frustrated at herself because she was being observed by her university supervisor. The visual stimulus helped Teresa realize that she needed to pay attention to what she wrote and ensure that it was what she told the students. If not, it could cause confusion to students. She was able to make a connection between her typo and student learning. In addition, she realized that she needed better planning and preparation (RoA) to ensure all information delivered to the students were accurate (RfA).

> I could have been more prepared for the lesson knowing that I would be teaching it and that I was observed. I would have felt more at ease and comfortable covering the content if I had reviewed the information and possibly role played to ensure I would convey the correct message both orally and visually.

Teresa's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as planning for instructions,

instructional strategies, and learning environment. The VAST she experienced was schema accretion because she added to her existing schema the new information of planning and preparation as well as specific things to do, such as reviewing or role playing.

CIR Form # 3. In this incident, Teresa noticed from the video that she and her partner revealed the concept being taught too soon in the class periods; thus, not giving student the opportunity to explore the subject. She was frustrated because she and her partner did not fully agree on how to introduce the lesson.

Teresa's video-aided reflecting (RoA) made her realize that she was only able to give the students partial opportunity to learn and inquire with their peers.

> I was not successful in introducing the science topic the proper way that I have been taught. Students were not as challenged as they would have been if I had started with the food coloring lab and discussed the other things in our everyday lives that diffuse as well. While I promoted an active learning environment it was not the ideal environment for meaningful learning.

Her reflection on her teaching experience helped her find out what she needed to do in her future teaching (RfA).

> I will go with my gut and do what I know is right for the students. Too many times I am intimidated by others and don't stand up for myself. In order to be effective in education I need to teach with my heart. I am convinced inquiry learning and the 5 E Learning Cycle are the most effective ways to engage and keep students learning everyday in my classroom.

Teresa's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as learner development, planning for instructions, instructional strategies, and learning environment. She experienced schema tuning and accretion because she had to adjust schema about how to collaborate with peers. As she said, she would go with her own gut and do what is right

for the students next time around if she had disagreement with her peer. She also added new information to her existing schema, which is using a variety of instructional strategies appropriately to support the learning.

CIR Form # 4. In this incident, Teresa noticed from the video that she was not engaging the students as she usually did although she was circulating in the class.

> I noticed that I did not circulate throughout the classroom and engage the students as closely as I normally would. I zipped from table to table but did not really have conversations with the students. I came up to tables and asked questions but before the students could answer I was on to the next one.

She realized that she seemed to be anxious to move onto the next step rather than spending more quality time with each group to engage the students (RoA). She needed to be more responsive to students' needs and create a learning environment that encouraged active engagement in learning and use better communications strategies to foster inquiry and interaction (RfA).

> In the future, as an educator, I will be more responsive to the needs of my students and not let trivial things get in the way of an engaging learning environment. My job is to allow every student the opportunity to learn and grow. There should be nothing that stands in the way of that goal. I feel if I can do that on a daily basis I will be an effective teacher.

Teresa's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as instructional strategies, including communication, inquiry, teacher-student interaction and learning environment. She experienced schema accretion by adding the above new information into her existing schema about effective teaching.

CIR Form # 5. In this incident, Teresa saw in the video that two students sitting in the front row were not focus on what is being taught and playing. They were seated up front so that the teacher could monitor their behavior during class. Teresa felt "very

frustrated and sometimes even take it personally" even though she knew she should not do that. She understood that students at that age liked to get attention and be called to answer questions.

> From the students perspective I am not receiving enough attention from the teacher and therefore I am seeking it out with a nearby classmate. I love to be called on and answer all of the questions being asked during a discussion.

She also elaborated that teachers should understand that not all students would be engaged in class activities (RoA).

> In the moment as teachers we can tend to forget that all students do not respond and actively learn the same way. As a teacher I need to be able to keep those "wandering students" actively involved in the classroom discussion.

Therefore, she used instructional strategies that actively involved those students who needed attention. She assigned them a specific job such as pointing to the illustrations and passing out the diagrams. She also ask one of those students to explain the cycles that they were covering so that she could just supervise because she understood students at this age love to stand up in front of the class and "teach".

During the transition from a discussion on the vocabulary words to the illustration on the board of the water cycle, Teresa also noticed some students at the back of the room took too long to make the transition. At first, she was frustrated because she had a lot to cover in the lesson, but she realized she was too impatient, which was confirmed by both of the members of her Critical Friends Group (RfA).

> From this video I have learned that I can be too impatient and cannot just stop and wait for an extended amount of time for a few students that are having trouble transitioning. If I wait too long I will lose the rest of the class and it will be difficult to gain their attention.|

Teresa's reflection on the video of her teaching helped her make connections among the various elements of teaching and learning, such as learner development and

Table 18

Teresa's Schema Development and VAST

	Fall 2011	**Spring 2012**
Schema Development	-Schema accretion (CIR forms: 1, 2, 3, 4) -Schema tuning (CIR form 3)	-Schema accretion (CIR form: 5)
VAST	-Schematization -Theorization	-Schematization -Theorization

learning environment, including time management, classroom management, and student engagement. She experienced schema accretion in her video-aided reflection because she added to her existing schema the new information of using instructional strategies to engage students: assigning specific roles to those students needing attention. Table 18 summarizes Teresa's schema development and VAST.

Summary

To sum up, Teresa focused on various elements related to teaching and learning when reviewing videos of her teaching and reflecting on her teaching experiences captured in the video, such as planning for instructions, instructional strategies, learner development, learning differences, learning development, and learning environment. The instructional strategies included different elements, such as time management and classroom management to create a learning environment that encourage inquiry and meaningful learning. Her video-aided reflection on her teaching practices helped her realize what needed to improve in her teaching (RoA) and how to improve it (RfA). She made rich connections among the different elements that were related to teaching and

learning, thus expanding her prior knowledge about teaching and learning. She constructed her knowledge through schema accretion and tuning.

The level of knowledge Teresa demonstrated in her CIR forms is mostly information with some characteristics of theory because her knowledge about teaching and learning were mostly contextualized, with some organizations. The phases/levels of learning she showed is intermediate or schema toward terminal or theory because most of her information about teaching and learning were concrete, contextualized, and organized in networks of related elements, as are demonstrated between and among the rectangle and the hexagon shapes in Figure 15, with some of the information integrated and logically ordered schemata as shown in the shapes of hexagon and diamond. Thus, she experienced schematization and theorization in her video-aided reflection. Teresa was at developmental stages between three and five because her reflection focused on developing teaching strategies, student learning, and learning environment

Interviews

Five participants – Becky, Daisy, Emily, Sheryl and Teresa, volunteered to participate in a phone interview to talk about their experience using digital video technology in their reflection and their VAST. The interview was audio recorded, transcribed, and analyzed. Following are the themes originated from the interview data.

Videos Helped Participants Notice and Reflect

All interview participants considered reviewing the videos of their teaching was very beneficial in helping them notice and reflect on what was going on in the classroom in their CIR forms. One of the topics that emerged from the interview was that video played a role of both visual stimuli and visual aid, as was described by Sheryl:

> I think it would make a difference if you reflect without a video because I feel like reflecting, if you watch yourself it helps you reflect more because you're reflecting on something and you don't have anything to watch it you're basing everything on your memory. If you can look at something over and over again and really reflect on it you would get more learning out of what you see verses by what you can remember because you can see it so I feel like the video thing is a cool thing.

Teresa also added,

> Making a video of yourself teaching is very, very helpful. I don't believe I can really look at my teaching without looking at myself actually doing it on a video because you see things you don't see or think about when you are actually teaching.

Emily agreed that "it was a useful experience because I saw some of my own weaknesses in that and there were certain areas where I would see myself being unsure." Both Daisy and Teresa also made similar comments that they would have never noticed their body language without the help of the videos. When talking about their general experience of using videos for their reflections, Sheryl stated that "I enjoyed it because I

was able to look at it and reflect on what I need work on and what I am really good at". She further explained,

> Being an upcoming teacher you really don't know, even though you take the courses and you read the books it's very different when you're doing it and you're trying to take all these theories and these strategies and trying to combine them together and teach and hope that the kids comprehend the information so it's a lot, and recording yourself helps you know when and where you can do it and when you can use the strategies you learn and where you can incorporate cooperative learning and where you can incorporate direct teaching. I enjoyed it, at first I was kind of hesitant about it because I was like oh my god everybody is going to watch me but overall I did like the experience. I learned a lot from it.

Becky also stated that the video reflection helped her to see what she would not be able to see without the videos: "It was interesting to see how the students reacted to what I said when I turned my back".

Video Helped Participants Become Aware of Needed Changes

The interview participants all agreed that what was more valuable to them was that the videos helped them become aware of what did not work and what needed change in order to improve their teaching. For Daisy, the videos help her be aware of things that she would not be aware of without the video.

> It assisted me in realizing some of the things I was doing that I was not aware of, it brought a little bit of reality to my teaching because you are so busy in actually teaching that you are not really aware of the tone of your voice, the volume or your facial or hand gestures…

Daisy talked about her focus of attention changed from teacher-centered to student centered in her CIR forms. Because of the benefits of videos in helping them reflecting on their teaching and helping them be aware of what they needed to improve, Becky, Emily, and Teresa mentioned that they even recorded some videos of their teaching or talking just for their personal and professional use because it could help them

realize what they needed to change and how to make the changes. For example, Teresa mentioned that she even recorded a mock interview to see what she needed to improve for her job search. As Daisy said,

> You learn from stepping back and looking back at yourself, you see it and you learn from it. You almost have to know your errors, your missteps, and showing your missteps then you can go back and make sure you don't make that misstep again.

The video-aided CIR forms made Emily aware of what she needed to change. She stated that the videos "made me more aware of the way I had been doing something that needed to be changed and so I made changes and it's sort of imprinted on my mind."

Becky also stated,

> It was nice to reflect on my own practices and see what worked and what didn't, see what things I was doing that I wasn't aware of, like taking long pauses to help a student, while not addressing the full classroom and giving them something to do. I really didn't think that I struggled with that, but after looking at the video I saw that even though I did help a student that had a question individually I didn't address the whole class and the whole class started talking and doing their own thing when I should have used that time to help them in another way or get them doing another assignment or something like that. In that aspect it helped at the time.

What Becky just mentioned above was one of the critical incidents she reflected on in her CIR form in Fall 2011. That incident must have been imprinted in her mind to remind her all the time. In addition, Becky talked about how her perspective changed in her reflections on the video that she was beginning to look at things from the students' perspective, not just from her own.

> I think I did take one time to kind of vent to the students a little bit and kind of reprimand them as a whole and I thought it would help with their engagement but it doesn't, so I learned that as well…. to talk to them individually about why, you know, why aren't we looking at the board or interested in the lesson. What can I make it better for you, taking it off of them and putting it more on me and seeing what can I do to help you instead of them always being at fault for not paying attention.

That also happened to Daisy because what she realized was not only how her hand movement can affect how the students perceive her, but also how her body language could affect those visual learners because they might feel disturbed by her hand movement. She also added, "I was looking at the students, looking at how they are perceiving me and I notice many times that I needed to do a little bit more prompting and inquiring. Stop and ask questions and inquire." Sheryl explained how her video-aided reflection helped her with her instructional plan and the implementation of instructional strategies.

> Recording yourself is important because you learn new things, you learn new skills and I would do whatever it takes for my students to get to grasp the concept even if that's recording to get to see what I have to work on. Students are different learners and if that means we need to incorporate a video and an activity and a little direct instruction in my activity in order for my students to learn I would do that but I also think in order for me to do that I would have to record my students and record me to see what can I work on.

VAST Could Help Participants Develop

Becky and Sheryl also talked about how the CIR helped them improve their teaching practice, which could have been caused by their VAST. Becky explained how CIR forms helped her change her teaching practice and her perception about her teaching practice.

> I felt that I wasn't letting them do a lot of hands on even though my philosophy of teaching is more hands on I wasn't really doing that in the class room. You know, looking at the video … I was looking at myself talking for the majority of the time. So, instead of them being disengaged or getting into trouble, I moved really towards inquiry rather than lecture and group work.

Sheryl also talked about how her CIR forms or what she learned from the video by reflecting on what she did in the video and how her reflection on action (RoA) and reflection for action (RfA) actually affected her reflection in action (RiA). Sheryl stated,

> By looking at the videos I noticed that in order for me to teach I have to move around. I cannot stay in one spot, I have to walk around and make sure everyone is ok, and I kind of learned that during my peer teaching and the video with the kids.

When she was teaching later after the video reflection, she was able to recall what she reflected in the video, which helped to adjust her actions while she was teaching.

> I did see myself at one point turning my back towards the kids and I noticed in my video … I also start seeing myself standing in front of the class room not walking around and I learned in the video walking around helps the kids be more attentive when I'm teaching.
> Those corrections that I sometimes forget, because I know they are there based on the video, I can correct them. when I notice I am trying to fall back in that comfortable stage or when I'm trying to fall back in, I feel like if it weren't for the video, I wouldn't have known, I wouldn't have known walking around was helpful for the kids. I would have never known that turning my back towards them gets them off task or gets them to do something else.

Becky echoed in her statement, saying "So I definitely think that without it (video-reflection), I would not be the teacher that I am today". Daisy also added similar comments:

> It would most definitely be different and I think it would be much better and when I say much better I mean in the terms of me becoming more aware of what I am doing and saying, how I'm saying it. More aware of what my students are doing when I'm actually teaching I have that awareness and I changed what I'm doing and how I'm doing it or even how I'm saying or speaking to the students.

Becky also mentioned how video reflection helped her better handle similar situations

> It has definitely helped me look at situations differently and think about how have I done this in the past and reacted to this certain thing in this way and that didn't work but I think that comes along with experience too

Just as Daisy summarized: "It permitted me to look and realize and then make accommodations and changes, be it my facial expressions, my hand movements, or I actually moved students because I saw the distractions."

Emily talked about how CIR helped her realize her teaching style and what she needed to do to help students understand the subject.

> I tend to do, because I'm older I tend to do things differently than they do now and you have to get adjusted to the culture of the youths. Instead of, I mean I can sit there and do the math but to explain it to an eleven or twelve year old is a whole different thing and that's really probably one of the things that really helped me a lot by watching myself on video was I learned I have to get the lingo down better I have to use more current and popular type examples in my teaching. I really learned a lot from the video.

Videos Helped Track Progress

Videos were also a good tool to track progress and changes. Becky saw her improvement in the videos.

> So I really liked that, also I did a couple of videos just for my own, you know, my personal viewing … and it was really cool to see how I progressed throughout the semester , from the beginning to you know the end of the semester.

Critical Friend Group Helped Reflection

When talking about her collaboration with Critical Friend Group, Sheryl said one of the advantages of reflecting with the help of others was that it helped her to look at things from another perspective.

> They helped me see things I didn't notice. Having a fresh pair of eyes other than your own is good because sometimes I wouldn't be able to look at what I did wrong and sometimes somebody else can and it was positive feedback.

All the interview participants agreed that one of the drawbacks of collaborating with Critical Friend Group was scheduling. Becky stated that "The assignment itself was kind of hard because we had different time schedules and things like that". Sheryl also pointed out that "because of the scheduling, because we were so spaced out, my group we were unable to go to their school to watch them teach." Becky, however, confirmed that

reflection with peers was beneficial because peers' feedback helped her look at herself and other things differently: "but it was nice to get other people's feedback on it and to see that the things that I was seeing as bad might not necessarily been as bad as I thought"

Daisy also stated that in collaborating with a peer, one needed to be aware of the differences between them. I think it's a tremendous assistance to the teacher; it gives them a big wakeup call and increases the learning curve.

> I believe and we had discussed this with some of my student teachers I was with this semester, is that in teaching every person has their own teaching style and that comes a little bit with your personality. You cannot make your entire personality go away so I know when peer are reviewing other videos I think they need to be aware of that personality of that person

To solve the problems that were caused by the difficulty of scheduling, Sheryl's group actually used an alternative.

> What actually happened was I had to record a lesson and the two members of my group, had to record the lesson and we came together and we watched each other's like that versus us going to the school and recording it we see each other's lessons. Which was really cool too, we got a chance to see how different styles we all teach which was really cool.

When talking about the future use of videos, Sheryl, Teresa and Emily all suggested that the video reflection activity should start earlier, possibly in their first year in the teacher education program. One of the reasons for starting early was that novice teacher could get comfortable with this kind of assignment and would be able to perform better in the video because they would not be so nervous as they would if it were just one shot. Another reason was that the videos could help them monitor their professional growth. Sheryl made some suggestions about the lesson plan.

> I think instead of doing all those lesson plans we had to do the first semester, I feel like they should have made us turn in two weeks of lesson plans and then the other two let them be recorded. You learn more when you can reflect on yourself, when you can see yourself doing it. That's my only suggestion doing it more than one time a semester; try to do it two times a semester.

Becky also recommended an alternative for how to better take advantage of the video-reflection activity. She said that it would be helpful if the whole class was able to view each other's videos and give feedback, such as using it as a warm-up activity.

> I think that maybe sharing our critical incidents with the class. We need to kind of get a discussion going maybe as a warm up every day. Somebody brings in their critical incident and that's how we segue into a lesson or something like that would be fun.

Summary

To sum up, the interview data as a means of triangulation to the documentary or text data indicated that videos-aided reflection was very beneficial to participants. It gave them the opportunity to look back and look closely at what they did in their teaching. It helped participants be aware of what needed to improve and how to make the improvements in their teaching. When reviewing and reflecting on the videos, participants were able to construct, restructure and reconstruct their knowledge by identifying what they needed to improve, and by elaborating how to make the improvements, which caused their schemata to change by accretion, tuning, and restructuring.

CHAPTER 5

DISCUSSIONS AND IMPLICATIONS

Introduction

This study was designed to explore novice teachers' cognitive processes, particular their video-aided schematization and theorization (VAST) through the investigation of the focus of novice teachers' video-aided reflection and how they connect the focus of their reflection to their prior knowledge and future actions or how does their video-aided schematization and theorization (VAST) work. This chapter consists of discussions of findings regarding the research questions, other findings that emerged from the data, implications for future research, and conclusion.

Discussion of Findings Regarding Research Questions

Research Question 1: Foci of Novice Teachers' Video-Aided Reflection

The findings indicated that participants focused mostly on the different aspects of instructional strategies and student learning, such as improving instructional planning and strategies to help learners develop deep understanding of content area and skills to apply knowledge in meaningful ways and creating a learning environment that acknowledge learner differences and development in terms of cognition and culture. The foci of participants' video-aided reflection evidenced in their CIR forms included mostly lesson plans, time management, classroom management, lesson planning, assessment of student knowledge and understanding, student engagement, collaboration, motivation, communications, and use of technology.

Table 19

Participants' Stage of Teacher Development, Levels of Knowledge and Learning, and VAST

Participants	**Stages of Teacher Development** (Fuller, 1990; Kwo, 1996)	**Levels of Knowledge** (Gadner, et al., 2004)	**Levels of Learning** (Korthagen & Lagerwerf, 1995)	**VAST**	**Schema Change**
Becky	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning
Daisy	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning
Elliot	Stages 1-2	Data-Information	Image-Schema	Schematization	Schema accretion, and tuning
Emily	Stages 2-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion
Kate	Stages 1-2	Data-Information	Image-Schema	Schematization	Schema accretion
Lance	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning,
Mariah	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and restructuring
Patricia	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning,
Sheryl	Stages 3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion
Ted	Stages3-5	Information - Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning
Teresa	Stages 3-5	Information -Theory	Schema-Theory	Schematization -Theorization	Schema accretion, and tuning

The findings also indicated that novice teachers' stage of development as teachers (Fuller, 1990; Kwo, 1996), levels of knowledge (Gadner, et al., 2004), phases of learning (Shuell, 1990), and levels of learning (Korthagen & Lagerwerf, 1995) are related and associated to their VAST and schema changes, as is illustrated in Table 19.

There are five stages of development for novice teachers, indicating their development of focus on self, immediate concern for survival, class control, desire to fit school, establish authority as a teacher and develop teaching strategies, focus on students' learning, and develop a deeper understanding of teaching and learning. There are three levels of knowledge that novice teachers develop. The first level is raw and incomprehensive data and facts, which is closely related to the initial or image phases and levels of learning. At this phase or level of learning, novice teachers hold a holistic or isolated facts and pieces of information. The second level of knowledge is information. At this level novice teachers' knowledge is contextualized, but unevaluated. Echoed in the phases or levels of learning, novice teachers develop schema or concrete and contextualized information in a network of elements and relationship. Therefore, the cognitive process incurred at this level of learning is called schematization. The third level of knowledge is the scientific theory. At this level, novice teachers' knowledge is organized and considered ultimate. Reflected in their phase or level of learning, novice teachers develop integrated schemata or logically ordered schemata called theory. The cognitive process at this phase or level of learning is called theorization.

As demonstrated in Table 19, eight participants' stages of development range from stage three to five. Their foci of reflection revolved around develop teaching strategies, focus on students' learning, and develop a deeper understanding of teaching

and learning. One of the participants – Emily was at the development stage of two to five because she showed concerns of fitting into school, which fell into stage two. Their levels of knowledge were at the range of information and theory, and their levels of learning were generally schema and theory. Accordingly, their VAST evidenced in their CIR forms indicated that they experienced schematization and theorization by connecting the various elements of as well as the schemata of instructional planning and strategies and learner development and learning differences. For example, Becky and Ted showed much richer schemata, which were organized in much more complex networks, in their video-aided reflections. They were able to make connections among various elements that were related to teaching and learning, such as student engagement, student knowledge, assessment, etc.

Two out of the eleven participants, Elliot and Kate, were at the development stages of one to two, meaning that their focus centered mostly on self and immediate concern for survival. Their levels of knowledge were mostly at the stage of data and some at stage of information, and their levels of learning were generally images with a few occasions of schema. Accordingly, their VAST evidenced in their CIR forms indicated that they saw mostly isolated images, with few occasions of schematization by connecting their action in class with student learning. For example, Elliot and Kate only saw isolated images in their reflections; thus, their schemata were much simpler if there were any. The foci of their reflection, in most cases, centered upon themselves: their bearing and their behavior. The foci of Elliot's video-aided reflection were about his voice being too soft, and he sat in the class, which he was not supposed to do. In addition, even if he talked about making changes in his future teaching, he was not able to give the

specifics about how to make the changes. This could be a sign that he did not have the resources to draw upon in his schemata. As a result, he would have a hard time responding to situations quickly, not to mention responding to different situations with little conscious effort (Korthagen & Lagerwerf, 1995; Shuell, 1990).

Research Questions 2: Participants' VAST

The VAST of participants varied from no schematization, schema accretion, tuning, and restructuring. Most of the schema changes of the participants were schema accretion, which is the addition of new information to existing schema (*see* Table 19). Considering that participants as novice teachers had not developed more complex schemata as experts do (Rumelhart, 1980), it should be reasonable that expanding their schema by adding new information or specific instances to their existing schema was their main cognitive processes.

Some of the participants experienced schema tuning by changing their existing schema to incorporate the new information, such as Patricia and Sheryl. Patricia had to change her schema about her instructional strategy and classroom management because she would not believe that she could stand behind the desk during the whole class session if she had not seen herself doing that in the video. She had to fine-tune her schema about herself and incorporate the new information from the video. Then, she made a conscious effort to change it. Likewise, Sheryl changed her perception about herself because of the positive feedback from the Critical Friend Group, realizing that her language were not as bad as she had thought, thus making her less self-conscious and more confident in her teaching. Only one participants – Mariah experienced schema restructuring or creation of new schemata triggered by new information.

Agreed upon by all interview participants, the videos provided the visual stimuli or prompts to draw their attention and made them aware of things they would have missed in their teaching. The reflection on their teaching experience helped participants realized what they had done wrong or what they needed to improve (RoA), and how they were to improve or what specific things they need to do to improve (RfA). Most of the participants were able to make connections among the various elements relevant to teaching and learning, thus expanding and fine-tuning their existing schemata or creating a new schema to incorporate new information. With more robust and complex schemata, novice teachers would be able to better handle everyday teaching (Korthagen & Lagerwerf, 1995; Shuell, 1990).

The findings verified Gould's (2000) statement that student teachers or novice teachers in their early phases of coursework and teaching change their schema for teaching in one of the four ways:

> (1) changing, enriching, or redefining some of their underlying concepts about teaching;
> (2) adding new concepts;
> (3) altering the connecting networks (changing the relationships among concepts); and by
> (4) adding new linkages among concepts (p. 98)

Gould (2000) pointed out that tracking the changes, especially "the subtle changes in beliefs, the development of more complex cognitive understanding, the shift from a focus on self to a focus on others", taking place as student teachers move through the teacher education program can be a valuable tool in assessing their growth and development.

Participants' Schema Development

One of the reasons that I have collected CIR forms from two semesters was to find out whether there was any development in the participants' schemata. The findings yielded mixed results. On the one hand, some of the participants showed development in their schema in Spring 2012 with the evidence of a much richer schema compared with those in Fall 2011, such as Kate. On the other hand, some showed less connections in their schema change in their CIR forms, such as Becky. Becky was able to make connection between various elements that were related to student engagement, student learning and the learning environment in her CIR forms in Fall 2011. She, however, focused only on classroom management and how to establish her authority as a teacher in her CIR form in Spring 2012, meaning that her schema did not develop by time and experience, as has been claimed in the literature (Rumelhart, 1980; Winn, 2004).

One of the explanations could be that a longer period of time was needed to bring about the change, as is proposed by Winn (2004) that our knowledge represented as schemata changes over time as we work with it. Another explanation could be that Becky demonstrated much richer schema in her CIR forms in Fall 2011 than in Spring 2012 probably because in the two semesters the scaffolding and collaboration opportunity the instructor had provided were different.

In Fall 2011, the instructor provided the students more scaffolding by giving them a sample CIR form. Meanwhile, students did not have peer reflection with Critical Friends. They reflected on the video of their teaching on their own. In Spring 2012, students were not given a sample CIR form to follow; instead, they did peer reflection with their critical friend. In her CIR form for Spring 2012, Becky mentioned that her

peers was not able to point out what she needed to do to improve in her teaching although they recommended to her what needed to be improved, meaning that the feedback Becky got from her peers might have been distracting her in her identification of the critical incident, as was mentioned in Lance's CIR form. The Critical Friends Group did not help Becky with her reflection and development of schemata. On the contrary, it could have hindered her reflection and schema development. Just as Becky wrote in her CIR form in the spring of 2011:

> The feedback that I received was very valuable to me because I felt that both of my group members really struggled to tell me what exactly I needed to do in order to change the behavior. It seemed very easily to identify the lack of control in the classroom but it was not too easy to state what should be done in order to fix it.

Moreover, the time might not be long enough for Becky to really show her growth in her schemata because an individual's schemata develop with experience over time, a time period that could be longer than one semester.

VAST and Teaching Practice

The findings indicated that VAST can possibly change novice teachers' teaching practice. For example, Patricia wrote in her CIR form that the incident she reflected on with the help of the video helped her change her teaching practice. Her reflection on the videos of her teaching made her be more aware of what changes were needed; therefore, in her later teaching she made conscious efforts to be close with her students rather than just standing at the front of the classroom. Just as she wrote: "I made an effort to move around the classroom more the next lessons and beyond", which was confirmed by her supervisor and one of the group members, as they did notice in her later videos that she did move around more in the classroom.

The interview data also indicated that all of the participants that I interviewed mentioned that the awareness of what they needed to improve helped them to change in their future teaching. For example, Sheryl described that she learned from her peer and practicum teaching that in order to engage students, she had to move around and make sure everyone was on task. In her later teaching, she immediately stood up and circulated around the classroom when she realized in class that she was sitting behind the desk. She wrote in her CIR form that she was able to recall the critical incident that she had reflected on in the videos and that helped her adjust her actions in her teaching.
Daisy also mentioned that she realized that she liked to talk with her hands and that could be distracting to students. Therefore, she made special effort not to do that in her later classes.

Discussion of Other Emergent Findings

Data from the CIR forms and the interviews indicated that video-aided reflection was a great tool to help novice teachers reflect on the videos of their own teachers. First, almost all of the participants agree that video provided the details of the classroom dynamics that would be impossible to recall without it. Just as Sheryl wrote,

> I did see myself at one point turning my back towards the kids and I noticed in my video … I also start seeing myself standing in front of the class room not walking around and I learned in the video walking around helps the kids be more attentive when I'm teaching…Those corrections that I sometimes forget, because I know they are there based on the video, I can correct them. when I notice I am trying to fall back in that comfortable stage or when I'm trying to fall back in, I feel like if it weren't for the video, I wouldn't have known, I wouldn't have known walking around was helpful for the kids. I would have never known that turning my back towards them gets them off task or gets them to do something else.

Research has also verified that video has the affordance to capture the complexity and reality of the classroom (van Es & Sherin, 2002; Wang & Hartley, 2003) that helps

teachers see things that they would have not without it, be aware of what they were doing and how their performance could affect student learning.

Awareness and VAST

"Awareness" was a word mentioned quite often by participants, such as in both of the CIR forms and interviews of Becky, Daisy, Emily, Sheryl, and Teresa. They stated that they were able to see more things and the relationship among those things, such as how a teacher's action could affect students. Considering awareness, consciousness and attention are the first step to incur cognitive activities, video technology is undoubtedly a useful tool for novice teachers' reflection, knowledge construction and professional growth and their development of VAST. In addition, when reviewing the videos of their teaching, novice teachers were able to make connections among the various elements of teaching and learning.

Age versus Experience in VAST

One of the findings indicated that age is not a deciding factor in our schema. Instead, it is our prior knowledge and experience that determine our schema, thus verifying that schema is subject-specific and domain specific (Rumelhart, 1980). For example, Elliot, at the age of 61 and over, did not have more complex schema than Becky, who is at the age between 18 and 22, although Elliot should have more life experience than Becky, but not necessarily more prior knowledge and experience about teaching and learning. In addition, Becky's prior knowledge about teaching and learning could be her memories about her high school teachers' teaching practice, which was still

fresh as she got into the teacher education program very soon after she graduated from high school.

Reflection Collaborating with Critical Friends Group

All of the participants who gave permission for me to use their CIR forms as data agreed that reflection with peers was beneficial because it provided the opportunity for the participants to look at their teaching from different perspectives. The findings, however, have indicated that some participants benefitted more than the others in their collaboration with their Critical Friends Group. For example, Kate was very thankful for her peers' feedback because it helped her build her confidence. As a result, she was not so nervous and self-conscious of her language, which not only affected her, but also affected her students' learning. Just as Kate stated that students were more comfortable and less nervous with a more confident teacher and were able to be more engaged in their learning. Likewise, Sheryl also mentioned that her peers did not think her language was as bad as she thought; thus, their feedback helped Sheryl change her schema about herself and became more confident in her teaching and less self- conscious of her language as well.

On the contrary, some of the participants pointed out that peer feedback could become distractions and could be too harsh. On the one hand, Lance mentioned that reflection with Critical Friends Group not only provided him with some good insights, but also helped him to look at teaching from a different perspective. On the other hand, peer's feedback could become distractions to him due to the differences in terms of personality and teaching as well as how they got their points across. Just as he stated in his CIR form,

> There can be some drawbacks in working collaboratively because there could be some personality differences. Each teacher has their own style of teaching and sometimes it just won't work out with another teacher. Sometimes allowing other teachers to watch you teach could become a distraction because some comments made by them are not always friendly criticism.

Becky's comment on the collaboration with the Critical Friends Group shared some similarities with that of Lance's: "I don't think that this assignment would be beneficial for individuals that don't reflect on the feedback that they receive and try to change some things in order to reach an ideal classroom." She further pointed out that "If the person receives feedback that is not well thought of or is not positive criticism then the person may not be able to grow from the experience."

One of my recommendations is that students are provided with specific instructions on how peers should collaborate, such as giving objective feedback, not being judgmental, showing peers with respect and being aware of how the feedback is communicated.

Limitations

There are several limitations in this study, which are associated with the theoretical and methodological framework, the context, and my personal background, value and culture. The disclaimer of the limitations is hoped to inform readers of this study for their interpretation, understanding, and use of the findings of this study.

The first limitation of this study is related to the theories, on which this study was developed, especially the schema theory. As the schemata of the participants were something that was going on in their mind, it had the ambiguity that could be very hard to measure accurately, which was also discussed in literature. One of the criticisms of schema theory in education focuses on "its vagueness and generality, theorists' inability

to describe exactly how schemata are constructed, and the comparably untested notion that the mind is somehow innately equipped with certain reflecting and reframing capabilities" (Reynolds, et al., 1996, p. 97). Thus, I used graphs, tables and detailed descriptions to explain the participants' schema change, and how the schema activities were detected and interpreted.

The second limitation is associated with the sampling of the study. The context of the sampling was within a southeastern metropolitan state university where a group of participants with a great difference in terms of prior knowledge, life experience, cognitive capability, personality, age, gender, and cultural background were enrolled in a teacher education program that used a various design, plan, instructional strategies, and processes to help the participants develop their expertise by reflecting on the videos of their teaching. Moreover, I was not able to establish the rapport with the participants and get the permission of the participants who participated in Fall 2011, which could affect the findings of this research in terms of tracing the development of participants' VAST.

The third limitation is related to what was used to measure the schema change because the schema change of the participants could only be measured by my interpretation of their CIR forms and some participants' interviews. Because people's ability of reflection varies from person to person, meaning that some participants might not be as reflective as, their mental cognitive processes were not able to be accurately recorded, which, in turn, affected my detection of the evidence of their schema change. If they were unwilling to be critical of their performance in teaching, there would be unlikely that I could detect what was going on in their mind. Thus, data from different sources were used for triangulation. The triangulation of the data was able to help. For

example, Sheryl was very eloquent and was able to better explain her cognitive processes in the interview than in her writings of the CIR forms.

The last limitation is linked to my cultural and educational background, and educational values, which might have affected the interpretation of the data. On the one hand, it could be a limitation in this study. Therefore, multiple raters were used in the data analysis to help offset the bias that could have incurred by a single rater. On the other hand, it could be an advantage in this study because I was able to better understand the feelings, and other factors that could have affected the performance of the participants who were from a different cultural and language background than the mainstream participants, such Kate

Recommendations for Future Design of Curriculum and Instructions

One of the recommendations is to incorporate the video-aided reflection practice earlier, such as right after the novice teachers have enrolled in the teacher education program, as suggested by some of the the interview participants. Starting this activity early can not only help novice teachers overcome their nervousness when they are being recorded, but also help track their professional development as a teacher. The decision of incorporating the practice earlier into the teacher preparation program can possibly be done at the stage of curriculum design.

The other recommendation is about the use of scaffolding and collaboration in the video-aided reflection task. When to provide scaffolding and how much scaffolding is provided needs to be considered in the lesson plan stage. Collaboration in video-aided reflection has been proven beneficial, yet meanwhile more specifications and rules needs

to be provided and followed, such as what kind of feedback to give and how to communicate when giving feedback.

Recommendations for Future Research

VAST, in this study, was used to measure novice teachers' cognitive processes when they are reviewing the videos of their own teaching. What I would be interested to see in future research is the VAST that novice teachers experience in the production of videos that demonstrate the critical incidents in their reflection. VAST can also be useful to explore in-service teachers' cognitive processes for their professional development to help them be aware of their teaching practice and see what needs to be improved. In addition, the concept of VAST can be applied to various contexts to detect the schema change in the construction, restructure, and reconstruction of knowledge, which is unnecessarily limited to teacher education. For example, I would be interested to see research of VAST in the field of language education, particularly in TESOL.

Conclusion

In conclusion, this study employed a qualitative case study approach to explore novice teachers' cognitive processes, particularly their video-aided schematization and schematization (VAST), when they were reviewing and reflecting on the videos of their teaching. The findings of this research indicate that participants focus on various elements of learning, mostly about classroom and time management, planning, instructional strategy, student learning, engagement, communication, meaningful learning, and learning environment. They experienced mostly schema accretion and tuning in their video-aided reflection to construct, restructure, and reconstruct their

knowledge of teaching and learning. In addition, the findings show that novice teachers' video-aided reflection on their teaching experience could help them be aware of what needed to improve (RoA) and how to make the improvements (RfA), or help them develop professionally.

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Appendixes

APPENDIX A

INFORMED CONSET FORM (COURSEWORK)
(FALL 2011)

Georgia State University
Department of Middle Secondary Education and Instructional Technology
Informed Consent (Coursework)

Title:	Exploring novice teachers' cognitive processes, particularly their schematization and theorization, using digital video technology
Principal Investigators:	Brendan Calandra, Anton Puvirajah
Student P.I.:	Yuelu Sun-Ongerth

I. Purpose:

We invite you to participate in a research study. The purpose of the study is to investigate novice teachers' cognitive processes. The cognitive processes occur when they watch the video of their own teaching, identify the critical incidents in the video, and complete the critical incidents reflection form. We invite you to participate because you have approved for us to collect your course artifact in EDSC 4470 course that you took in Fall 2011. To fully address our research question, we need to collect more data -- your course artifact for EDCI 4640 course you are taking in Spring 2012. We will recruit 15 participants for this study. You do not need to do extra work to participate in this study.

II. Procedures:

If you decide to participate in the study, you will allow us to make copies of both of your written and video assignments that you have completed in Spring 2012 in EDCI 4640 course, Critical Issue Middle Grade – Critical Thinking Through Writing. You will also allow us to use them as research data. You will receive a five-dollar Starbucks gift card for your participation.

We will select some of your assignments for this study. They are: 1) the two videos that you have recorded for the critical incidents analysis of your practice teaching; and 2) the two completed critical incidents reflection forms. We will collect your written and video coursework once they are due and have submitted to your instructor, who is not part of this research team. As you are recruited directly through our research team, your instructor of the EDCI 4640 course will not know who have been recruited. We will not include any of your video-taped teaching episodes in reports or professional presentations without your express permission.

Again, your giving us permission to use your coursework will not incur any of your time.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Overall, we hope to gain information on how to better use technology in the Science Education program. We also hope that this experience may help you grow as a teacher.

V. Voluntary Participation and Withdrawal:

You can choose to participate in the study or not to. You do not have to be in this study. If you decide to be in the study, but change your mind later, you have the right to drop out at any time. If you choose not to be in the study, you will not be punished in any form. Your course grade will not be affected in any way by your participation in the study or by your withdrawal.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. Only Dr. Brendan Calandra, Dr. Anton Puvirajah, and Yuelu Sun-Ongerth will have access to your information. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board, the Office for Human Research Protection (OHRP). We will use pseudonyms rather than your name on study records. Consent forms and pseudonym code keys will be stored in a separate filing cabinet from research data. Audio and video recording will also be kept private. Following is the detailed description of the procedure.

As your reflection forms and the videos, which are the course artifacts we would like to examine to answer our research questions, are due, Yuelu Sun-Ongerth will meet you before or after the class when you submit your course artifacts and collect them. Once Yuelu Sun-Ongerth received your course artifacts, she will remove your names from the reflections forms and assign pseudonyms. Your video files will also be assigned pseudonyms that match with the reflection forms. A code sheet matching student names to pseudonyms will be kept securely in a locked filing cabinet in room 632, College of Education. Your name and other facts that might point to you will be removed from materials and will not appear when we present this study or publish its results. You will not be identified personally in any means.

We might contact you at the end of the Spring semester or at the beginning semester of 2012 and invited you to participate in an interview. The interview will be audio recorded.

Once the interview is complete, Yuelu Sun-Ongerth will edit the audio file of your interview to alter your voice. Nobody will be able to recognize your voice. She will also replace your name with a pseudonym if it is mentioned in the interview.

You can choose to participate in the study or not. You do not have to participate in the interview even though you have consented for us to use your reflection forms and videos. If you would allow us to contact you for the interview, please provide your contact information at the end of the form. If you decide to participate in the interview, but change your mind later, you have the right to drop out at any time. Due to resource limitations, we can only invite five to seven people who consent to share your reflection forms and videos for the interview. The interview will be semi-structured (open ended). It will be the basis for clarifying and extending the ideas that you presented on the reflection form and will be used as opportunity to member check our interpretations. Yuelu Sun-Ongerth will conduct the interview and the interview will be audio-recorded.

VII. Contact Persons:

Contact Dr. Calandra at (404) 413-8420, e-mail bcalandra@gsu.edu, Dr. Puvirajah at (404) 413-8414, e-mail apuvirajah@gsu.edu, or Yuelu Sun-Ongerth at (404) 413-4710, e-mail ysun7@gsu.edu if you have questions about this study. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404)413-3513 or svogtner1@gsu.edu.

VIII. Copy of Consent Form to Participant:

We will give you a copy of this consent form to keep.

If you are willing to volunteer, please sign below.

_____ _____

Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

Do you allow us to contact you for the interview? (Please circle) Yes No

If your answer is “Yes”, Please provide your contact information below.

_____

Your contact information

APPENDIX B

RECRUITMENT SCRIPT
(FALL 2011)

Hello! We would like to invite you to participate in a research study conducted by Dr. Anton Puvirajah, who is your EDSC 4470, Concepts and Methods in Middle Childhood Science course, class teacher; Dr. Brendan Calandra, who is an Associate Professor in MSIT, and Yuelu Sun-Ongerth, who is a doctoral student in MSIT.

The purpose of the study is to investigate the cognitive process that occurs when novice teachers: a) watch the video of their own practice teaching, b) identify the critical incidents in the video, and c) complete a critical incidents reflection form. We have invited you to participate because you are enrolled in the Concepts and Methods in Middle Childhood Science course. You do all of these things as a part of your coursework. We are hoping to gain more understanding about the use of video technology and how to better use technology to help students like you in teacher education programs. We want to stress that your participation is very important in helping us with the research. We also hope to help you with your practice teaching as a part of the process.

If you decide to participate in the study, you will allow us to photocopy some of your assignments that you have completed in Fall 2011 in EDSC 4470: Concepts and Methods in Middle Childhood Science, and to use them as research data. The assignments to be selected include: a) the two videos that you have recorded for the critical incidents analysis of your practice teaching, and b) the two completed critical incidents reflection forms. You will also be asked to fill out a short demographic survey that includes your name, age, ethnicity, and your years teaching experience. Don't worry; pseudonyms will be used in any forms of reports to protect your identity. No one will be able to connect the data to you. You may also be selected for an open-ended interview about your experience using digital video technology in this course. The interview will last from 30 to 45 minutes and will be audio-recorded. It will be conducted by Yuelu Sun-Ongerth during Spring 2012 at a time and location of your choice. You will be contacted by e-mail if you are selected for the interview. The interview will also be kept anonymous. Due to resource limitations, only five to seven of the consenting students who allows us to use their coursework will be recruited to participate in the interview.

As an appreciation for your time and participation, you will get a five-dollar Starbucks gift card. You will get an extra ten-dollar Starbucks gift card for your participation in the interview.

We will need you to sign one consent form for coursework and a separate consent form for the interview if you decide to participate.

Again, your written and video work will be copied, but we will ensure that they will

not be analyzed or used until after the course grade has been submitted. To protect your confidentiality, your name on the course work will be replaced with a pseudonym once it is collected so that your identity cannot be identified. Only Yuelu Sun-Ongerth will have the pseudonym coding key. Your records will be stored in a locked filing cabinet in Dr. Puvirajah's office at the University. Audio and video recording will also be kept private. Your name and other facts that might point to you will be removed from materials and will not appear when we share our results.

Your participation in the research is voluntary. If you decide to be in the study and change your mind later, you have the right to drop out at any time. If you choose not to be in the study, you will not be punished in any form. Your course grade will not be affected either way by your participation in the study, or if you decide to withdraw from it.

If you have questions about the research, please contact Dr. Calandra at (404) 413-8420, e-mail bcalandra@gsu.edu, Dr. Puvirajah at (404) 413-8414, e-mail apuvirajah@gsu.edu, or Yuelu Sun-Ongerth at (404) 413-4710, e-mail ysun7@ gsu.edu. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404) 413-3513 or svogtner1@gsu.edu.

We thank you in advance for your participation!

APPENDIX C

INFORMED CONSET FORM (COURSEWORK)
(SPRING 2012)

Georgia State University
Department of Middle Secondary Education and Instructional Technology
Informed Consent (Coursework)

Title:	Exploring novice teachers' cognitive processes, particularly their schematization and theorization, using digital video technology
Principal Investigators:	Brendan Calandra, Anton Puvirajah
Student P.I.:	Yuelu Sun-Ongerth

I. Purpose:

This is an invitation to participate in the second part of our study.

The purpose of the study is to investigate novice teachers' cognitive processes that occur when they watch video of their own teaching, identify critical incidents in the video, and complete a critical incidents reflection form.

We are inviting you to participate in this part of the study because you permitted us to collect your course assignments in EDSC 4470 - *Concepts and Methods in Middle Childhood Science*. You took EDSC 4470 in Fall 2011.

In order to fully address our research question, we need to collect more data. We would now like to collect your course assignments for EDCI 4640 *Critical Issues in Middle Grades Education – Critical Thinking Through Writing*. You are taking this course in Spring 2012. We will recruit 16 participants for this study, please note that participation will not include any extra work on your part.

II. Procedures:

If you decide to participate in the study, you will allow us to collect both of your written and video assignments completed in Spring 2012 in EDCI 4640, and use them as research data. You will receive a $5 Starbucks gift card for your participation.

The assignments we would like to use are: 1) the two videos that you have recorded for the critical incidents analysis of your practice teaching; and 2) the two completed critical incidents reflection forms. We will collect your written and video coursework once they are due and have been submitted to your instructor. Your EDCI 4640 instructor is not part of this research team. Because you are recruited directly through our research team, your EDCI 4640 instructor will not know who has been recruited for

our research. In addition, we will not include any of your video-taped teaching episodes in reports or professional presentations without your express permission.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Overall, we hope to gain information on how to better use technology in the University Science Education program. We also hope that this experience may help you grow as a teacher.

V. Voluntary Participation and Withdrawal:

You can choose whether or not to participate in this part of the study. If you decide to be in the study, but change your mind later, you have the right to drop out at any time. If you choose not to be in the study, you will not be punished in any form. Your course grade will not be affected in any way by your participation in the study or by your withdrawal.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. Only Dr. Brendan Calandra, Dr. Anton Puvirajah, and Yuelu Sun-Ongerth will have access to your information. Information may also be shared with those who make sure the study is done correctly such as the GSU Institutional Review Board, the Office for Human Research Protection (OHRP). We will use a pseudonym rather than your name on study records. Consent forms and pseudonym code keys will be stored in a separate filing cabinet from research data. Audio and video recordings will also be kept private.

Yuelu Sun-Ongerth will meet with you before or after class the day you submit your course assignments (reflection forms and videos) and collect a copy of them. Once Yuelu Sun-Ongerth has received your course artifacts, she will remove your name from the reflection forms and assign a pseudonym. Your video files will also be assigned a pseudonym that match with the reflection forms. A code sheet matching student names to pseudonyms will be kept securely in a locked filing cabinet in room 632, College of Education. Your name and other facts that might point to you will be removed from materials and will not appear when we present this study or publish its results. You will not be identified personally in any means.

We might contact you at the end of Spring 2012 or at the beginning of the Summer semester of 2012 and invite you to participate in an interview. The interview will be audio recorded. Once the interview is complete, Yuelu Sun-Ongerth will edit the audio

file of your interview to alter your voice. Nobody will be able to recognize your voice. Ms. Sun-Ongerth will also replace your name with a pseudonym if it is mentioned in the interview.

The interview will be completely voluntary. A $10 Starbucks card will be provided for the five to seven interview participants we select. If you would like us to contact you for the interview, please provide your contact information at the end of this form. If you decide to participate in the interview, but change your mind later, you have the right to drop out at any time.

VII. Contact Persons:

Please contact Brendan Calandra at (404) 413-8420, bcalandra@gsu.edu, and Yuelu Sun-Ongerth at (404) 413-4710, ysun7@gsu.edu, if you have questions about this study. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404)413-3513 or svogtner1@gsu.edu.

VIII. Copy of Consent Form to Participant:

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this part of our study, please sign below.

_____ _____

Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

Do you allow us to contact you for the interview? (Please circle) Yes No

If your answer is “Yes”, Please provide your contact information below.

_____

Your contact information

APPENDIX D

RECRUITMENT SCRIPT
(SPRING 2012)

Hello!

We would like to invite you to participate in a second-round of data collection for our research on using digital video for teachers' professional development. We are contacting you because you have already participated as a part of EDSC 4470 *Concepts and Methods in Middle Childhood Science*.

In order to better answer our research questions, we would now like to collect some of your course assignments for EDCI 4640, *Critical Issues in Middle Grades Education – Critical Thinking Through Writing*, in Spring 2012.

The members of our research team include Dr. Puvirajah, who was your instructor for EDSC 4470, Dr. Brendan Calandra, who is an Associate Professor of Learning Technologies, and Yuelu Sun-Ongerth, a doctoral student in the Instructional Technology program at GSU.

The purpose of the study is to investigate the cognitive processes that occurs when novice teachers: a) Watch videos of their own practice teaching, b) identify critical incidents in the videos, and c) complete critical incidents reflection forms. We are hoping to gain more understanding about the use of video technology and how to better use technology to help students like you in teacher education programs. We want to stress that your participation is very important in helping us with our research.

If you decide to participate in the study, you will allow us to collect some of your assignments that are required for EDCI 4640. They are a) The two videos that you have recorded for the critical incidents analysis of your practice teaching, and b) the two completed critical incidents reflection forms. Don't worry, we will replace your name with a pseudonym to protect your identity, and no one will be able to connect the data to you.

You might also be selected to participate in an interview about your experience while using digital video in this course. Due to resource limitations, only five to seven students who have allowed us to use their coursework will be recruited to participate in the interview. The interview will last less than 45 minutes, and it will be audio-recorded. Yuelu Sun-Ongerth will conduct the interviews at the end of the Spring semester, 2012 or at the beginning of the Summer semester, 2012. The interview will happen at a time and location of your choice. You will be contacted by e-mail if you are selected for the interview. The interview data will also be kept completely anonymous.

As an appreciation for your time and participation, you will get a $5 Starbucks gift card for letting us use your coursework. You will get an extra $10 Starbucks gift card if you participate in the interview.

We will need you to sign one consent form for coursework, and a separate consent form for the interview if you decide to participate.

To protect your confidentiality, your name on the coursework will be replaced with a pseudonym once it is collected so that you cannot be identified. Only Yuelu Sun-Ongerth will have the pseudonym-coding key. Your records will be stored in a locked filing cabinet in Dr. Puvirajah's office at the University. Audio and video recordings will also be kept private. Your name and other facts that might point to you will be removed from materials and will not appear when we share the results.

Your participation in the research is voluntary. Because you are recruited directly through our research team, your EDCI 4640 instructor will not know who has participated and who has not. If you decide to be in the study and change your mind later, you have the right to drop out at any time. If you choose not to be in the study, you will not be punished in any way. Your course grade will not be affected in any way regardless of whether you participate or not.

If you have questions about the research, please contact Brendan Calandra at (404) 413-8420, bcalandra@gsu.edu, Anton Puvirajah at (404) 413-8414, apuvirajah@gsu.edu, or Yuelu Sun-Ongerth at (404) 413-4710, ysun7@ gsu.edu. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404) 413-3513 or svogtner1@gsu.edu.

We thank you in advance for your participation!

APPENDIX E

INFORMED CONSET FORM (INTERVIEW)

Georgia State University
Department of Middle Secondary Education and Instructional Technology
Informed Consent (Interview)

Title:	Exploring novice teachers' cognitive processes, particularly their schematization and theorization, using digital video technology
Principal Investigators:	Brendan Calandra, Anton Puvirajah
Student P.I.:	Yuelu Sun-Ongerth

I. Purpose:

This is an invitation to participate in the third part of our study.

The purpose of the study is to investigate novice teachers' cognitive processes that occur when they watch video of their own teaching, identify critical incidents in the video, and complete a critical incidents reflection form. The purpose of the interview is to get participants perspectives on the video-aided reflection experience.

We are inviting you to participate in an interview because you allowed us to examine your coursework for EDCI 4640 *Critical Issues in Middle Grades Education – Critical Thinking Through Writing*, and because you provided permission for us to contact you for an interview.

Your participation in the interview will require less than 45 minutes of your time. The interview will happen at the end of Spring 2012 or at the beginning of the Summer semester of 2012.

II. Procedures:

We have selected you to participate in the open-ended individual interview. We used the information you gave us in the coursework consent form to contact you. If you decide to participate in the interview, you will allow Yuelu Sun-Ongerth to interview you. You will also receive a $10 Starbucks gift card for participation.

The interview will not happen until we have collected your course reflection forms and videos from EDCI 4640. During the interview, Yuelu Sun-Ongerth will ask you about your experience in general. She will also ask you how digital video technology that you used in this class might have affected your knowledge about teaching and learning. Yuelu Sun-Ongerth will audio-record the interview. The interview will last less than 45 minutes. The interview will take place at a place and time of your choice.

III. Risks:

There are no anticipated risks associated with this interview.

IV. Benefits:

Overall, we hope to gain information on how to better use video technology in the Science Education program at your University. We also hope that this experience may help you grow as a teacher.

V. Voluntary Participation and Withdrawal:

You can choose whether or not to participate in the interview. If you decide to participate in the interview, but change your mind later, you have the right to drop out at any time. You may skip questions or stop taking-part at any time. If you choose not to be in the interview, you will not be punished in any form. Your course grade will not be affected in any way by your participation in the interview or by your withdrawal from participation.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. Only Dr. Brendan Calandra, Dr. Anton Puvirajah, and Yuelu Sun-Ongerth will have access to your information. We may also share the information with those who make sure the study is done correctly – the GSU Institutional Review Board, the Office for Human Research Protection (OHRP). We will use a pseudonym rather than your name on all study records. Consent forms and pseudonym code keys will be stored in a separate filing cabinet from research data. The audio recording will also be kept private.

Once the interview is complete, Yuelu Sun-Ongerth will edit an audio file of your interview to alter your voice, so that nobody can recognize your voice. She will also replace your name with a pseudonym if it is mentioned in the interview. We will keep two copies of the audio recording: an original master copy, and a working copy. We will not make further duplication unless one of the copies becomes unreadable or damaged. We will destroy the code key soon after data collection and analysis. We will keep all collected data for an additional two years after the dissemination of the study. We will then destroy all data securely. We will remove your name and other facts that might point to you from materials. We will ensure that they will not appear when we present this study or publish its results. Nobody will be able to identify you via the data or reports on the data.

VII. Contact Persons:

Please contact Brendan Calandra at (404) 413-8420, bcalandra@gsu.edu, and Yuelu Sun-Ongerth at (404) 413-4710, ysun7@gsu.edu. If you have questions or concerns about your

rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404)413-3513 or svogtner1@gsu.edu.

VIII. Copy of Consent Form to Participant:

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this interview stage of our study, please sign below.

_____ _____

Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

APPENDIX F

VIDEO-AIDED CRITICAL INCIDENT REFLECTION ASSIGNMENT (COURSE SYLLABUS, FALL 2011)

Critical Incident Report and Video of Teaching (Individual)

You will video-tape yourself teaching during at least 2 class sessions. View the video of your lesson individually and identify two critical incidents in each video. The critical incident that you select should be a short video segment (2 to 4 minutes) which you have identified as being interesting to delve deeper into. Please see below for details. Submit your video on the critical incident report.
Critical Incident Reflection Form

What are Critical Incidents?
Critical Incidents are the "oops," "ouch," "aha…," or "oh…" moments that you experience during a teaching episode or as you watch your videotaped lesson. The incident may be something that "amused" or "annoyed," was "typical" or "atypical," or was a "felt difficulty" or "felt success." In our case, critical incidents will be identified from the video recordings of your lessons.

Why use Critical Incidents?
One goal of using critical incidents is to help you look beyond the experience of the incident to the meaning of the incident. This is a form of reflection-on-action. Another goal is to help you develop your ability to reflect on these incidents as they happen, or reflection-in-action. Finally, using critical incidents can help you adjust your lesson and strategies for future teaching cycles, or reflection-for-action.

How do I reflect on the Critical Incidents that I select?
Remember, there is no "right" or "wrong" way to select an incident. It should be something useful and meaningful to you. After watching and editing your videotaped lesson for critical incidents, use the statements and questions below to guide you as you reflect on two critical incidents that you selected from your recordings of your teaching. (two per video)

Incident: Provide a short title for the incident

Where (1 point)
Provide the time segments where the critical incident begins and ends. (E.g. 01:15 to 03:05)

What (2 points)
Provide an in-depth description of the event. Try to write this without judgment or interpretation.

Emotions (2 points)
Describe the feelings you had as you "experienced" the incident.

Why (6 points)
Explain the incident from the perspective of each participant (parent, teacher, student etc.). Use "I" for each participant's explanation.

Portfolio Standards (2 points)
Which of the portfolio standards do you think can be addressed through this experience and briefly explain how/why?

Cultural Relevance (4 points)
In what ways did you employ culturally relevant teaching? (For example, communicating high expectations for all students; using cultural referents for imparting knowledge, skills, and attitudes; creating a learning environment that honors and promotes cultural diversity; helping students challenge the status quo.) You might begin with "As an educator, I was/was not able to. …"

Position (4 points)
What are some of your personal beliefs related to teaching and learning that you identified when reflecting on this incident and the portfolio standards that you addressed. You might begin with "As an educator, I believe/value. …"
Actions (4 points)
After considering this incident, what will you do differently in the future in light of your new understandings? You might begin with "As an educator, I will…."

Total 25 points

Example of Completed Critical Incident Form (not a perfect assignment)
-Critical Incident Report (Practicum Teaching)

Incident: While My Back Was Turned!

Where (1 point)
Provide the time segments where the critical incident begins and ends. (E.g. 01:15 to 03:05)

The critical incident segment is 23:00-30:00min.

What (2 points)
Provide an in-depth description of the event. Try to write this without judgment or interpretation.

The event that I will give a description of left me saying, "Ooops!" The lesson that I recorded was from my practicum teaching experience. As I was watching my lesson over again, I noticed the group that was closest to the camera. In this group were three boys

and one girl. This group's objective for the lesson was to build an inclined plane (one of the six simple machines) and be able to explain through words and use how it works.

During this lesson I had 4 groups and made sure to travel around the room in order to observe and check on each group. I came up to the inclined plane group and began to ask them about their activity and what they had constructed. I offered them some suggestions. I also noticed that this group might be tempted to get off task and stop working so I brought them two toy cars so that they could try using their inclined plane and see how it worked. As soon as I gave this group the cars I turned around and began talking to another group. The inclined plane group immediately began playing with the toy cars and appeared to stop working on their inclined plane all together.

Emotions (2 points)
Describe the feelings you had as you "experienced" the incident.

The feelings that I had as I experienced this incident were discouragement, embarrassment, and frustration. I felt that I should have given this group more materials to work with and more challenging instructions to keep them engaged and working. I also felt frustration and embarrassment with myself because I actually thought that giving this group the toy cars would help them become more engaged in the inclined plane activity. Instead, they moved on to playing and getting off task almost immediately. I was also disappointed and embarrassed because as soon as I gave this group the cars, I turned around and moved on to another group. I was embarrassed that as a teacher I did not spend more time working with these students and trying to engage them in this lesson and their group task.

Why (6 points)
Explain the incident from the perspective of each participant (parent, teacher, student etc.). Use "I" for each participant's explanation.

Student- I was working in a group during this lesson. Ms. Ball gave us a basket of supplies and a lab sheet that explained that we were supposed to build an inclined plane. We used our wood box, board, and string to construct and inclined plane that looked like a ramp. We built our ramp pretty quickly. Our ramp wasn't very stable, so when Ms. Ball came around to check out what we built she saw that it was not stable. She went to her supplies and brought our group back two toy cars. Ms. Ball told us to try to tighten up our ramp and use the cars to test it. Ms. Ball turned around to help the group next to us. I began to try using the car and working on the ramp, but the other people at my table we just playing. So then we just started talking and playing with our cars while Ms. Ball walked away.

Teacher- As students were working in their groups I spent time walking around to each group and checking on their progress. Some groups were building two simple machines and others were just building one. I encouraged the students on their work and answered their questions. I also tried to give students advice and ask them questions about how they could make their simple machines better. I walked up to my inclined plane group and I

saw that they had built a ramp. Their ramp was not very sturdy, so I brought them two toy cars to use to test the ramp that they build. I told this group to work on their ramp some more and use the toy cars to test their machine to make sure it worked correctly. I then turned around and began talking to and working with the group behind the inclined plane group.

Portfolio Standards (2 points)
Which of the portfolio standards do you think can be addressed through this experience and briefly explain how/why? The incident that occurred can be best addressed though the Doman 2: Knowledge of Students and their Learning standards:
2.2 understand how learning occurs in general and in the content areas (e.g., how diverse learners construct knowledge, acquire skills, and develop habits of mind).
2.3 are sensitive, alert, and responsive to all aspects of a child's well-being.
2.4 understand how factors in environments inside and outside of school may influence students' lives and learning.

I feel that these three standards best address this incident because as a teacher I should have been more alert and responsive to the inclined plane group during this lesson. I did not fully understand how the factors in the classroom environment affected these students' learning that day. I feel that I should have showed better understanding of how learning occurs in my students and given them more materials to engage in deeper inquiry about inclined planes and their usages. Instead, I gave this group a car to use to demonstrate the usage of an inclined plane and it merely distracted my students. In the future, I will keep these standards in mind and be more sensitive and responsive to the learning environment and needs of my students.

Cultural Relevance (4 points)
In what ways did you employ culturally relevant teaching? (For example, communicating high expectations for all students; using cultural referents for imparting knowledge, skills, and attitudes; creating a learning environment that honors and promotes cultural diversity; helping students challenge the status quo.) You might begin with "As an educator, I was/was not able to. …"

As an educator I was able to give students an opportunity to learn, engage, and inquire with their peers. I was able to introduce a new science topic to the classroom, by drawing on student's prior knowledge and everyday activities that involve simple machines. Students were challenged with a basket of supplies, a lab guide, and a mission. I challenged each group to create one of the six simple machines using just the supplies they were given. I encouraged students to create simple machines keeping in mind the many types of them that they use each day. As an educator I was able to create a learning environment that honors and promotes diversity and values the ideas and input of students. I do feel thought that my expectations for students were not high enough at times during this lesson. I feel that I was not able to challenge students enough at times so that they did not have time to get off task. I feel that this lesson went very well, but I could be a more culturally relevant teacher if I work harder to challenge students in a way that creates an even richer learning environment than in this lesson.

Position (4 points)
What are some of your personal beliefs related to teaching and learning that you identified when reflecting on this incident and the portfolio standards that you addressed. You might begin with "As an educator, I believe/value. …"

While experiencing this critical incident or "ooops" moment as I watched my practicum teaching video, I was able to identify several personal beliefs that I have related to teaching. The main belief I have, is that as an educator I should be providing each student with the same attention, respect, and worth. I believe that it is extremely important for teachers to pay attention to all of their students and do their best to help each and every student succeed. During my critical incident, I feel that I did not give my inclined plane group the attention they needed and I also did not require them to work as hard to think as critically as I required the other groups to. I know that during my lesson, I was more concerned with completing the lesson and getting through all of the activities than I was with each student truly learning how their simple machine worked and feeling that it was important. This was my first time teaching in my practicum experience, and there are a lot of improvements that I have made and want to continue to make. My main concern with this critical incident, is that I was not able to make the right call in giving my inclined plane group materials. I feel that I should have given them enough materials to have every person building a type of inclined plane so that they would be engaged in hands-on learning. I also think that I should have only given them the toy cars at the very end to demonstrate how their inclined planes work. This way I could monitor their use of the cars and not allow them to get away with playing while the other groups were still hard at work. This can be very distracting for a class if others are playing and not off task, and I should have seen this happening and done something about it. I also believe as an educator that it is my job to notice if a group is not working well together or staying on task and intervene. I believe that as an educator it is important for us to exercise good classroom management skills at all times and I did not do this as well during this critical incident.

Actions (4 points)
After considering this incident, what will you do differently in the future in light of your new understandings? You might begin with "As an educator, I will…."

In light of my new understandings, as an educator I will be more responsive to each student and group in my class. I will also have a clearly defined classroom management policy so that if a few students are not on task or are playing instead of working I will be able to remove them from their group and have an activity that they can work on independently. For future labs and hands-on activities in which I have students work in groups, I will be sure to have at least two or three extra stations available for students who get off task or need to work independently. This will give me an easy and effective way to manage discipline in my class when there is a lot going on and I am trying to give each group my attention and input. The final thing that I will do differently in the future is to make sure that students do not get away with playing during an activity because I am too busy helping other groups and trying to keep the time of the lesson. While watching

this incident, it appeared that I was satisfied with how all of the students were doing and I was relieved that my inclined plane group had at least engaged and worked for a few minutes. It appeared that this was enough for me from this group, as they usually do very little in class. Unfortunately, I wish I had given this group more challenges and more materials so that they would stay engaged. But instead, I rewarded them with toys and didn't stop them from playing because I was too busy working with other groups. I regret that I let this group get away with playing, and I regret that I did not have higher expectations with them. I want to have higher expectations of my students in the future because I feel that high expectations motivate students to do better and achieve more!

APPENDIX G

VIDEO-AIDED CRITICAL INCIDENT REFLECTION ASSIGNMENT (COURSE SYLLABUS, SPRING 2012)

Critical Incident Assignment Guidelines*

Critical Incidents are the 'oops,' 'ouch,' 'aha...,' or 'oh…' moments that you experience during a teaching episode or as you watch your videotaped lesson. The incident may be something that 'amused' or 'annoyed', was 'typical' or 'atypical', or 'felt difficult or 'felt successful.' One goal of using critical incidents is to help you look beyond the experience of the incident to the meaning of the incident. This is a form of reflection-on-action. Another goal is to help you develop your ability to reflect on these incidents as they happen, or reflection-in-action. Finally, using critical incidents can help you adjust your lesson and strategies for future teaching cycles, or reflection-for-action. Remember, there is no "right" or "wrong" way to select an incident. It should be something useful and meaningful to you.

Video and Presentation Requirements:

You will be required to share your critical incidence video during one pre-determined class session. The following pieces of the project are due on the day you are scheduled to present:
10 copies of backwards design lesson plan for the lesson covered in your video.
10 minute edited video segment(s) to share in class on your assigned presentation day.
A verbal summary of your ideas/thoughts on the video clips and overall lesson.
Questions to guide the class in discussion of / reflection on your video segment(s).

Reflection Paper Requirements:

The final reflection paper is due within 2 weeks (14 days) of your scheduled presentation date and should include the following components submitted via LiveText.

Description of the Critical Incident:
What: Provide an in-depth description of the event. Try to write this without judgment or interpretation.

Emotions: Describe the feelings you had as you 'experienced' the incident.
Why: Explain the incident from the perspective of each participant (student, teacher, etc.). Use 'I' for each participant's explanation.

Analysis of the Critical Incident:

Standards & Proficiencies:
Which of the Standards for Middle Level Teacher Preparation are related to this incident? (review NMSA Initial Standards document on LiveText)

Which Content Standard(s) (from GPS) does this teaching episode cover?

Cultural Relevance: Were you able to employ culturally relevant teaching? Examples include (1) socially important issues; (2) relating your content area to the community; (3) building on student background knowledge that is culture-specific; (4) communicating high expectations for all students; (5) helping students challenge the status quo. You might begin with "As a teacher, I was/was not able to…"

Position: What are some of your personal beliefs related to teaching and learning that you identified when reflecting on this incident. You might begin with "As a teacher, this incident shows that I believe/value…"

Peer feedback: Summarize the feedback you received from peers and respond to it briefly. This might feed into your action plan below.

Actions: What do you learn from viewing the critical incident? Specify steps that you will take to improve your teaching practices in response to this critical incident. After considering this incident, what will you do differently in light of your new understanding? You might begin with "As a teacher, this incident directs me to…"

Backwards design lesson plan should be included as an appendix.
Adapted from, "The Role of Digital Video and Critical Incident Analysis In Learning to Teach." Laurie Dias, AERA, 2008.

APPENDIX H

INTERVIEW PROTOCOL

Introduction

Hi, (Participants Name)! How are you doing? Are you going to start teaching in the fall semester?

I want to thank you again for your participation in my study and for allowing me to interview you today. In today's interview, I will first go over the procedure of getting your verbal permission and then I will ask you some questions about your experience of using video technology in your classes during Fall 2011 and Spring 2012. If you do not understand my question, please stop me, and I will repeat. If you do not want to answer a question, please feel free to do it.

Before we start, I want to tell you that I guarantee that your name will not be used anywhere in my research. A pseudonym will be used to protect your identity. Nobody will be able to identify you by any means.

Procedure Questions

Let's go over the procedure first. I will ask you some questions about your permission for me to interview you.

1. Would you please tell me your name?

2. Would you allow me, Yuelu Sun-Ongerth to interview you for my research?

3. Are you aware that this interview is audio-recorded?

Thank you, (Participants Name)! Let's talk about your experience with the video reflections.

Guiding Interview Questions

1. Would you please describe your experience using digital video technology in your courses during Fall 2011 and Spring 2012?

2. Would you please explain how the critical incidents you identified in the video affected you in terms of your later teaching practice?

3. Would you please give an example about how your reflection on the videos affected you I handling similar situations in your teaching?

4. In the spring of 2012, you had the opportunity to reflect on your video with peers. Would you please explain whether reflection with peers made any difference from reflection on your own?

5. Do you have anything else to say about the video-reflection activity you did?

6. Do you have any comments and suggestions about the future use of this technology?

7. Do you have any questions for me?

Thank you again for your time and participation! I will send you the transcript of our today's interview for you to check the accuracy.

You have a wonderful day, (Participants Name)!

APPENDIX I

CRITICAL INCIDENT REFLECTION FORM

What are Critical Incidents?
Critical Incidents are the "oops," "ouch," "aha…," or "oh…" moments that you experience during a teaching episode or as you watch your videotaped lesson. The incident may be something that "amused" or "annoyed," was "typical" or "atypical," or was a "felt difficulty" or "felt success."

Why use Critical Incidents?
One goal of using critical incidents is to help you look beyond the experience of the incident to the *meaning* of the incident. This is a form of *reflection-on-action*. Another goal is to help you develop your ability to reflect on these incidents as they happen, or *reflection-in-action*. Finally, using critical incidents can help you adjust your lesson and strategies for future teaching cycles, or *reflection-for-action*.

How do I reflect on the Critical Incidents that I select?
Remember, there is no "right" or "wrong" way to select an incident. It should be something useful and meaningful to you. After watching and editing your videotaped lesson for critical incidents, use the statements and questions below to guide you as you reflect about the two-three critical incidents that you selected.

Incident:

What
Provide an in-depth description of the event. Try to write this without judgment or interpretation.
Emotions
Describe the feelings you had as you "experienced" the incident.
Why
Explain the incident from the perspective of each participant (student, teacher, etc.). Use "I" for each participant's explanation.

Critical Incident:

Portfolio Standards
Which of the portfolio standards from content knowledge, teaching performance, and impact on student learning are addressed in this incident?
Cultural Relevance
In what ways did you employ culturally relevant teaching? (For example, communicating high expectations for all students; using cultural referents for imparting knowledge, skills, and attitudes; creating a learning environment that honors and promotes cultural diversity; helping students challenge the status quo.) You might begin with "As an educator, I was/was not able to. …"
Position
What are some of your personal beliefs related to teaching and learning that you identified when reflecting on this incident and the portfolio standards that you addressed. You might begin with "As an educator, I believe/value. …"
Actions
After considering this incident, what will you do differently in the next lesson in light of your new understandings? You might begin with "As an educator, I will…."

APPENDIX J

CODING GUIDEBOOK FOR FOCI OF REFLECTIONS

(*Note*: The InTASC model core teaching standards (2011) provide a guideline for coding the focus of novice teachers' video-aided reflection. Sub-categories should be identified in the coding. For example, instructional strategies may include classroom management, time management, verbal communication and use of media and technology for communication.)

The InTASC Model Core Teaching Standards (April 2011)

The Learner and Learning

Standard #1: Learner Development
The teacher understands how learners grow and development, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences
The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environment that enable each learner to meet standards.

Standard #3: Learning Environment
The teacher works with others to create environment that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self motivation.

Content Knowledge

Standard #4: Content Knowledge
The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teachers and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content
The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practice

Standard #6: Assessment
The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard #7: Planning for Instruction
The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies
The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice
The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration
The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession

APPENDIX K

CODING GUIDEBOOK FOR VAST

Schema accretion occurs when the new information can easily fit into a slot in an existing schema, and thus be quickly comprehended. It is a simple addition of new information into existing schema. Schema accretion is similar to fact learning, and information is remembered that was used as an instance within a schema as a result of text comprehension or understanding of an event(Rumelhart & Norman, 1981).

Schema tuning occurs when the existing schema has to be adjusted to accommodate the new information; thus, making the existing schema more accurate, complete, or useful. In other words, existing schemata become more consistent with experience, incorporates minor schema modification (Rumelhart & Norman, 1981).

Schema restructuring occurs when the new information cannot fit into an existing schema; thus, an entirely new schema has to be created to replace or incorporate the old ones in order to hold the new information (Rumelhart & Norman, 1981).

Schematization is the process of forming schemata. It is originated in a need for more clarity. This clarification of the new images and new experiences provides an individual the opportunities to explain and justify what they are doing, and to verify the result. It occurs when an individual's schema changes by schema accretion, tuning, and restructuring (Korthagen & Lagerwerf, 1995).

Theorization is originated in a need for the organization of the constructed schemata. It is the logical structuring of the schemata. It occurs when an individual is making a network to connect different schemata (Korthagen & Lagerwerf, 1995).

APPENDIX L

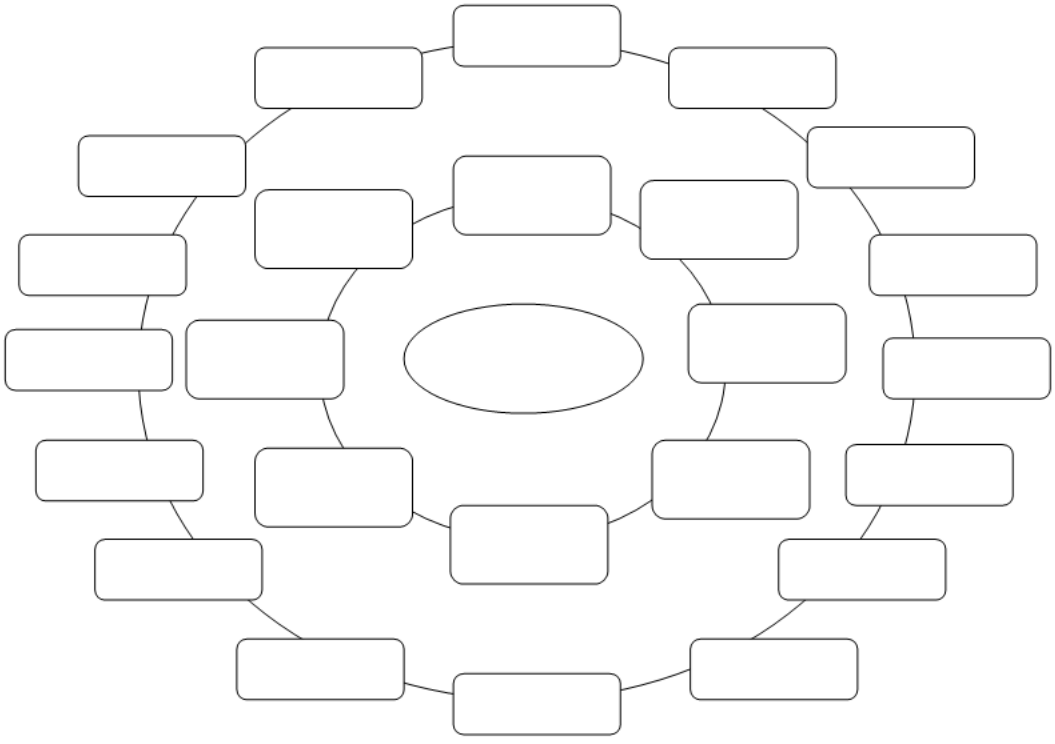
CODING FORM

Pseudonym of Participant: _____

Instructions for Coding: The coding form consists of two parts: Foci of Video-Aided Reflection and the VAST Table. The Network of Schema graph is used to label the foci of the participant's video-aided reflection as well as the relationship between or among the foci. Fill out the slots with the identified foci of the participants' reflection. Draw a line to indicate the relationship between or among them. There is no need to indicate the direction of the relationship. A slot may be connected to more than one slots to indicate its relationship with multiple elements. The central circle should indicate the visual stimulus, which is what participants see in the video. Refer to the Codebook for Foci of Participant's Reflection to regulate the terms used for the identified foci of reflection (see Appendix J).

The VAST Table is used for the identified schema activity of the participant. Refer to the VAST coding guide book as a guide in the determination of the schema activity of the participants the Schema Coding guide (see Appendix K).

Foci of Vide-Aided Reflection



Participant's VAST

Types of Schema Change	*Yes or No*	*Supporting Evidence*
Schema Accretion		
Schema Tuning		
Schema Restructuring		
Schematization		
Theorization		